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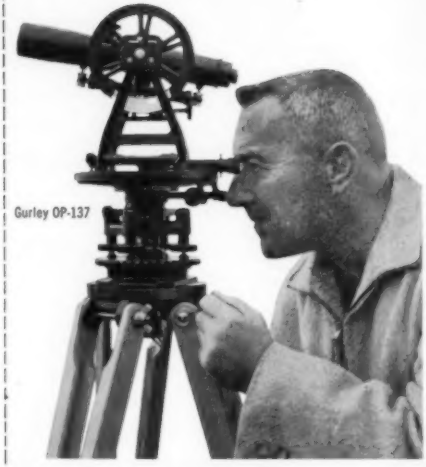

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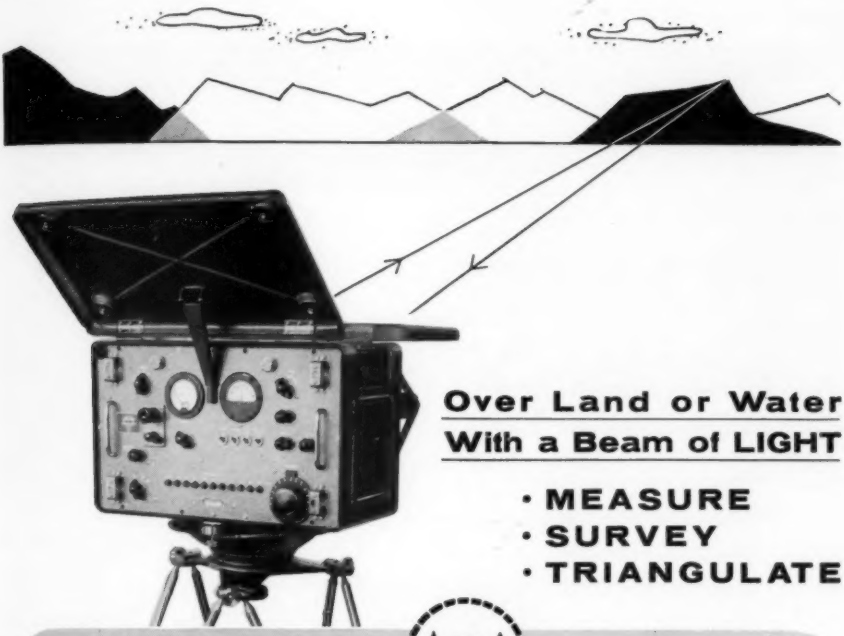

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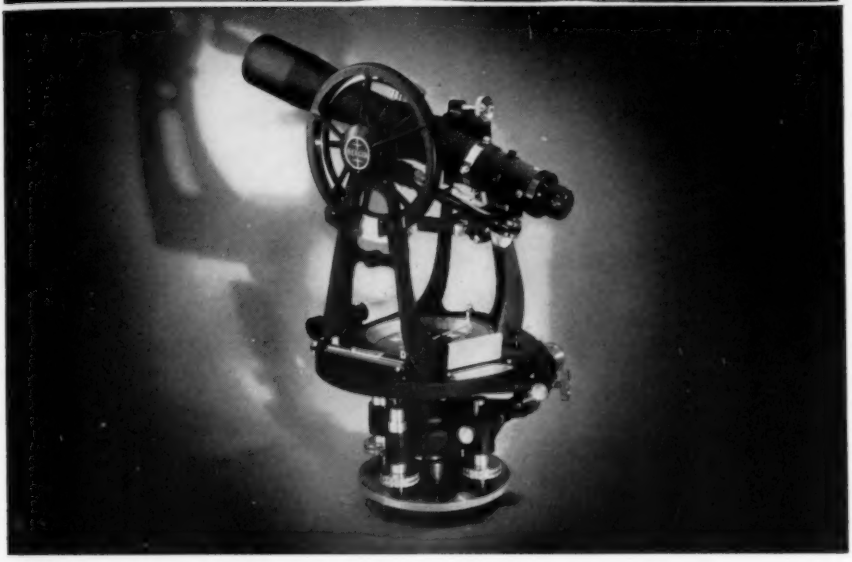

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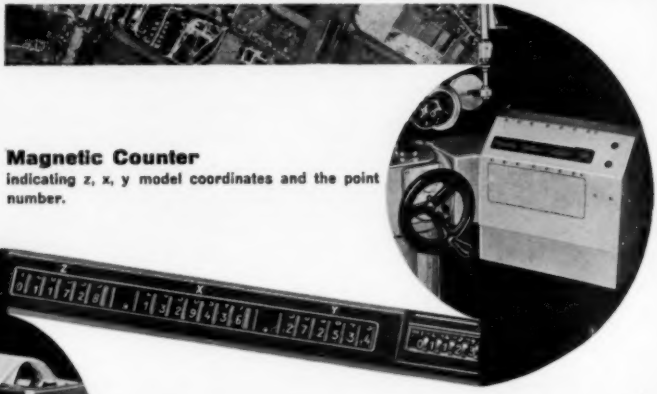

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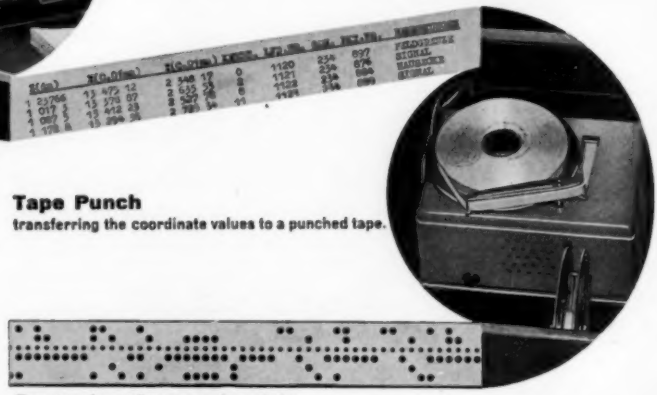

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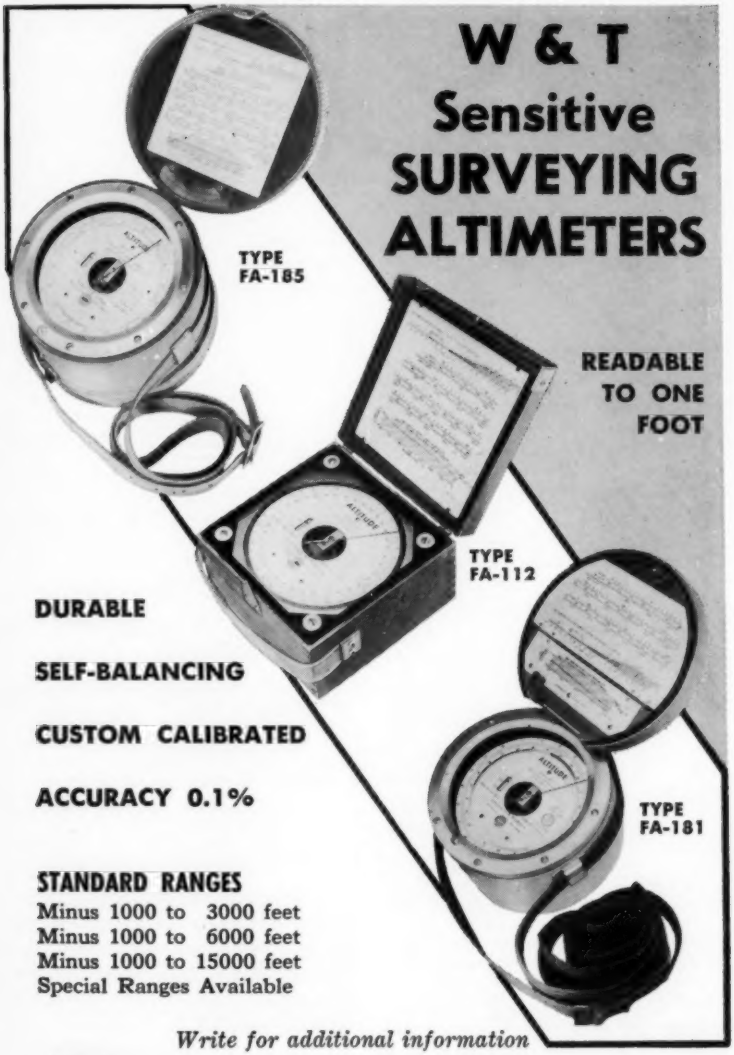
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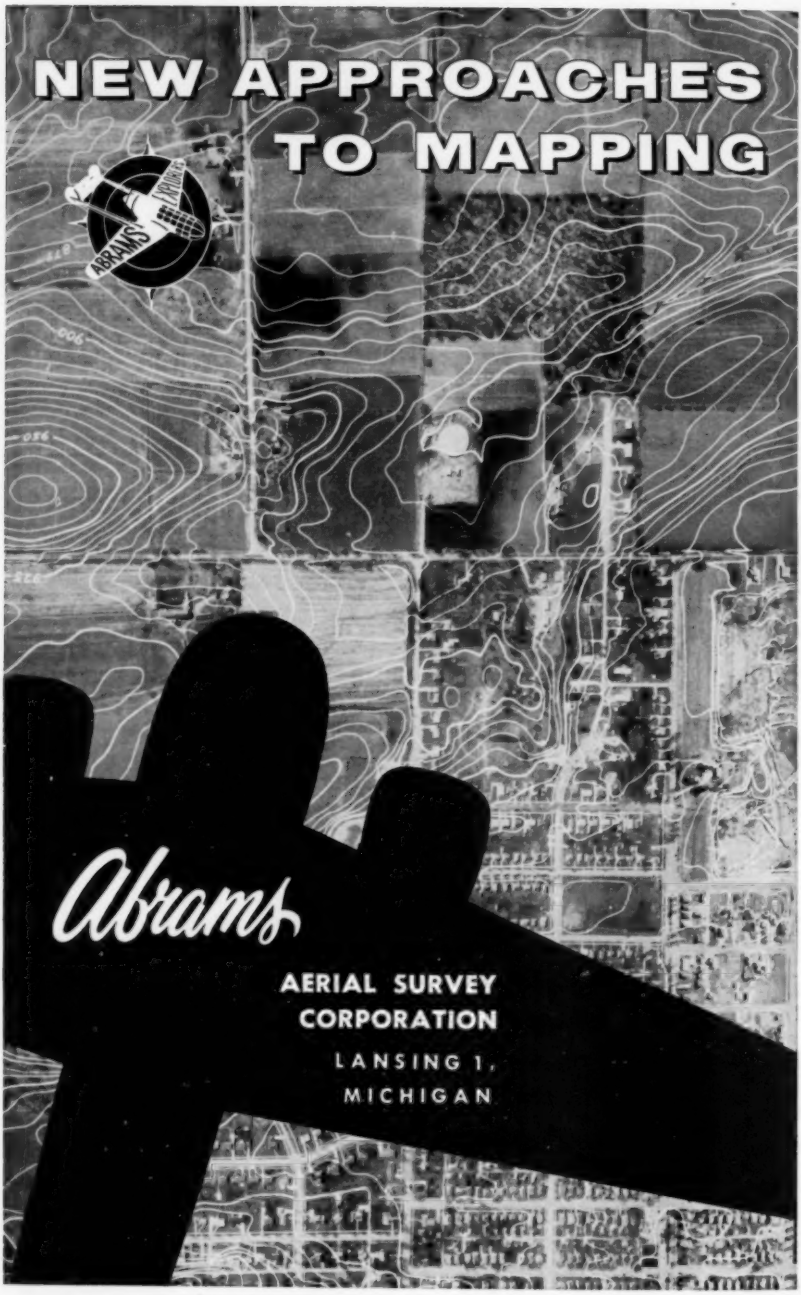
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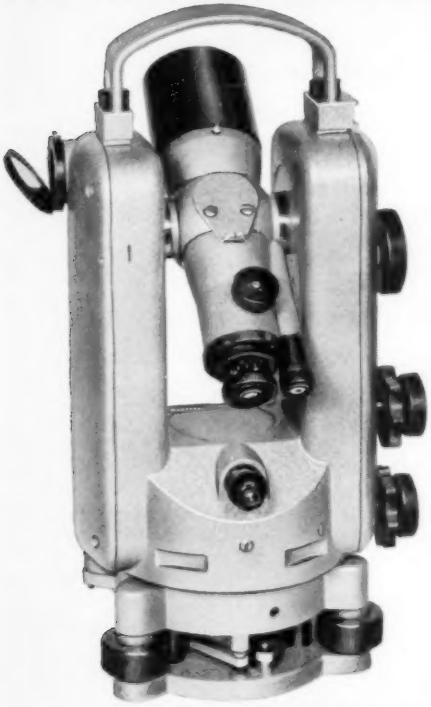

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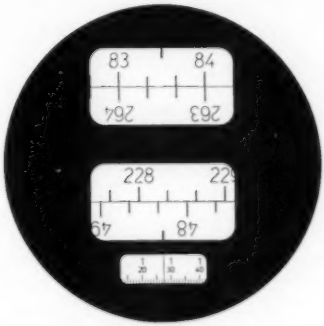

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Introducing the New President of ACSM

PRESIDENT W. B. WILLIAMS

W. B. Williams, President of ACSM for 1958, was born in Grand Rapids, Michigan, where he has resided ever since. "Bill" Williams, as he is known to most of us, graduated with a B.S. degree from Michigan State College in 1921 and ten years later received his C.E. degree from the same school. A registered land surveyor and registered civil engineer in Michigan, he has been Kent County Surveyor since 1939, when he succeeded his father who had held the County Surveyor's office since 1892.

In 1924, father and son, and two others, incorporated their private practice under the name of Williams and Works. They have been active in all phases of land surveying, mapping, property development, sanitary engineering, and highway engineering since that date, operating primarily in western Michigan. W. B. (Bill) Williams has been president of that organization since 1931. His son, Ted, also with land surveyor and professional engineer registration, is now an officer of the firm, and, as "Bill" points out with justifiable pride, there are early indications that his grandson is inclined toward traversing those traditional family trails.

"Bill" is Vice President of the Michigan Title Company, a Past President of the Michigan Society of Registered Land Surveyors, and a Director of the Michigan Engineering Society.

A member of ACSM since 1949, "Bill" Williams has served on ACSM's Advisory Council. He has been Chairman of ACSM's Property Surveys Division. An active leader in the formation of the Great Lakes Section of ACSM, "Bill" Williams was its first chairman. He was elected to the vice presidency of ACSM in 1957. From this heritage of background and activity, he was nominated, elected, and now assumes the duties and responsibilities of the office of President of the American Congress on Surveying and Mapping for the 1958 term.

The Eighteenth Annual Meeting

THE American Congress on Surveying and Mapping and the American Society of Photogrammetry held their Annual Consecutive Meetings and Co-Exhibits at the Shoreham Hotel in Washington, D. C., during the week of March 23, 1958. This year ACSM opened the week with its Eighteenth Annual Meeting and ASP closed the week with its Twenty-fourth Annual Meeting.

This cooperative arrangement between these two closely associated national organizations offers an unusual opportunity for surveyors, cartographers, photogrammetrists, educators, instrument makers, and many others to meet each other and to exchange ideas. This year's program attracted persons from all parts of the United States as well as from many other countries of the Western Hemisphere. Also, the registrants included several from Europe. The total registration was excellent, exceeding 1700.

Dr. Lawrence Gould, President of Carleton College, delivered the Keynote Address. Dr. Gould, who has served as Director of the U. S. Geophysical Year Antarctic Program, recently was asked to serve as the U. S. representative on the International Committee responsible for guiding the continuing program in Antarctica. In emphasizing the need for geophysical research in that ice-covered continent, he stressed the importance of accurate maps and charts of the area to be used in obtaining scientific data and then later to serve as base on which much of this information would be depicted.

Plenary Sessions

Each of the six Technical Divisions arranged a Plenary Session on a subject of special interest to that Division, but yet of general interest to all members. Also, each Division held a separate technical meeting combined with a brief business meeting at which division officers were either elected or appointed.

CARTOGRAPHY DIVISION

The program for the technical meeting of the Cartography Division, held Monday morning, March 24, in the Park Room, consisted of a panel discussion on "Technical Trends in Map and Chart Compilation and Drafting." Chairman John A. Law was the Moderator and other members of the panel were John M. McAlinden, Coast and Geodetic Survey; Frank A. Clements, Aeronautical Chart and Information Center; Raymond J. Mercil, Army Map Service; and Duncan M. Fitchet, Rand McNally and Company. Each member of the panel briefly described particular phases of compilation or drafting as carried on in his agency.

The Chairman announced the election of two new directors, Gordon B. Littlepage and Robert L. Moravetz, to serve for a term of two years. Granville K. Emminizer will be the Chairman this year.

The Cartography Division will be the Washington host for foreign delegates to the Second International Convention on Cartography, sponsored by Rand McNally and Company in Chicago, June 23–27, 1958.

CONTROL SURVEYS DIVISION

The Control Surveys Division meeting was called to order at 10 a.m. Monday, March 24, 1958, in the Blue Room, by Chairman Professor Arthur J. McNair. Dr. John A. O'Keefe presented a very interesting paper on "Satellite Methods in Geodesy." This paper will be published in a future issue of the Journal. After Dr. O'Keefe's paper, there was discussion of the need for aid from the Control Surveys Division in the program of the "Society of Photographic Scientists and Engineers." There is a need for locating phototrack stations from existing geodetic horizontal control. Any astronomers who are engaged in the phototrack program and who need to have their observing stations connected to control stations should communicate with the Con-

trol Surveys Division of the ACSM, and every effort will be made to have the desired ties to existing control accomplished.

The chairmen of the standing committees of the Control Surveys Division are as follows:

Membership—Emery Snyder
Research and Development — Julius Speert
Technical Standards—William Laidly
Public Education—Ralph Berry
Nominating—Capt. A. J. Hoskinson

Reports were presented by the committee chairmen. Capt. Hoskinson reported that Director Robert G. Blanchard had found it necessary to resign. It was, therefore, necessary to elect two new Directors. The committee nominated Richard G. Watts, Magnolia Petroleum Company, Dallas, Texas; and Daniel E. Whelan, Dean of Engineering, Loyola University, Los Angeles, California. There were no nominations from the floor, and their election was unanimous. The present Directors are:

Lansing G. Simmons, *Chairman*—	1959
Richard G. Watts	1960
Daniel E. Whelan	1961

On Monday, March 24, at 1:30 p.m., Professor McNair presided at the plenary session sponsored by the Control Surveys Division. This meeting was devoted to a panel discussion entitled "Tellurometer: Electronic Distance Measuring." The members of the panel were:

Kendall B. Wood, President, K. B. Wood and Associates, Portland, Ore.

Lieutenant Hal P. Demuth, Coastal Surveys Division, Coast and Geodetic Survey, Washington, D. C.

S. G. Gamble, Chief Topographic Engineer, Surveys and Mapping Branch, Department of Mines and Technical Surveys, Ottawa, Canada

William O. Baker, President, Michael Baker, Jr., Inc., Rochester, Pa.

Capt. Carl I. Aslakson, Geodetic Engineer, Aero Service Corporation, Philadelphia, Pa.

Donald D. Mears, Electronic Specialist, Tellurometer, Inc., Washington, D. C.

EDUCATION DIVISION

The technical session of the Education Division was held in the Tamerlane Room of the Shoreham Hotel in Washington, D. C., on Monday morning, March 24th, between 10:00 and 12:00. Professor Sumner B. Irish, Chairman of the Division, presided at the meeting, which had an attendance of about forty persons, nearly filling the room.

The principal speaker, Professor Francis H. Moffitt, Division of Civil Engineering, University of California, Berkeley, presented a paper on "The Engineering Measurement Approach to Engineering Education," expounding a revolutionary concept in engineering training for the college freshman level. Basically, his paper dealt with the content of a course used at his school to replace the usual (and too often inadequate) Freshman Surveying course. Called "Engineering Measurements," the course was designed to acquaint the student with all types of engineering measurement—electrical, civil, etc.—emphasizing basic concepts of accuracy, error, and standards. The speaker contended that this approach was much more sound than the practice of having all students take basic surveying, a course for which some students would never have further use.

Three prepared discussions of this paper followed, respectively by Professor John O. Eichler of the Georgia Institute of Technology, Professor Ralph M. Berry of the University of Michigan, and Professor Charles L. Miller of the Department of Civil and Sanitary Engineering of the Massachusetts Institute of Technology. The three speakers agreed independently that Professor Moffitt's approach was sound, but they contended that the course should be delayed until the Junior or Senior years, when the students have a better background for it. They questioned also the availability of adequate teachers for such a course. Professor Moffitt answered that the course was generalized for the freshman level without loss of significant content, and he stated that no difficulty was experienced at the University of California in obtaining instructors qualified to teach the course.

After a lively discussion from the audience, including remarks about such work in European universities, the meeting was adjourned at 12 noon. A short business meeting followed, during which a new Chairman, Professor Leo V. Nothstine of Michigan State College, was elected to succeed Professor Irish.

INSTRUMENTS DIVISION

The Instruments Division staged demonstrations of actual distance measurements, both with the Tellurometer and with the Geodimeter, in the late afternoon and early evening of Monday, March 24th.

During the latter part of the afternoon of Tuesday, March 25th, Chairman Thorpe presided at a plenary session featuring papers by Dr. Robert P. Multhauf, "Early Instruments and the History of Surveying," and by Milton E. Compton, Jr., "The Geodimeter—Progress Reports on Distance Measurement with Light Waves."

The Instruments Division held no formal business meeting. Clifford A. Thorpe, Jr., continues as Chairman of the Division for the year 1958.

PROPERTY SURVEYS DIVISION

The Property Surveys Division held a technical session on Monday morning, March 24, was in charge of part of the plenary session the same afternoon, and held its annual business meeting late Tuesday afternoon.

A. Philips Bill, Chairman of the Division, presided at the technical session which was designated as a Land Surveyors Annual National Conference. The session consisted of reports from four Division committees on subjects vitally important to all property surveyors.

As Chairman of the Model Surveyor's Registration Law Committee, Curtis M. Brown presented a draft of the model registration law (designated Proposal No. 1) developed by the committee, and explained the thinking underlying the proposal. Copies of the draft were distributed to all members present. After some discussion, the membership unanimously approved three resolutions, introduced by Chairman Brown, requesting continuation of the work of the committee, suggesting related studies for this or another committee, and requesting authority for, and help in, distributing the proposal to other organizations and individuals.

During the discussion that followed, Victor H. Ghent, Secretary of the Division, passed out copies of a preliminary printing of his compilation on "State Registration Requirements Concerned With the Profession of Land Surveying," and explained that final printing in SURVEYING AND MAPPING would probably be in the July–September issue.

James M. Bell, Chairman of the Fees and Salaries Committee, stated that his committee had been instructed to study the resolution adopted by ACSM in 1949 on the same subject, with a view toward recommending changes, if needed. The committee, he said, found that the first part of the previous resolution, which presents a code of ethics and defines the obligations of the professional surveyor to his client, did not need to be altered; but that the second part, dealing with minimum fees, needed to be modified as the result of changes in wage and salary rates during the past 10 years.

Mr. Bell distributed to those present copies of a comprehensive questionnaire which the committee proposed to send to all property surveyors in an effort to obtain information from all parts of the country concerning fees, salaries, hourly rates, and related data, so that the committee could prepare a realistic recommendation.

Those present unanimously approved a resolution, offered by the committee, requesting authorization to distribute the questionnaire, to compile and study the resulting data, and to report at the 1959 annual meeting.

The Ethics Committee, through its Chairman, Sol A. Bauer, recommended adoption of one or the other of the two codes of ethics for engineers already in existence and widely accepted, with the addition of such stipulations as are particularly applicable to surveyors. The codes cited were those of the American Society of Civil Engineers and the National Society of Professional Engineers.

Mr. Bauer, speaking for himself, suggested adoption of the NSPE code (which he read) with the addition of a paragraph to the effect that documents on technical standards and ethical fees, already adopted by ACSM, shall be considered as a part of the code.

He proposed, and those present approved, a resolution that the committee be asked to review and finalize his suggestions for submission to the Executive Committee of the Division for possible eventual adoption by ACSM.

The report of the Fair Labor Standards Committee was given by Gordon E. Ainsworth, Chairman. He made reference to the discussion at the previous annual meeting by representatives of the Wage and Hour and Public Contracts Division of the Department of Labor,[1] and stated that subsequent to that presentation there has been a contradictory court decision—a decision which appears, for the moment at least, to have negated information given out by the Labor Department representatives and caused a great deal of confusion among surveyors. It is believed, however, that the decision might be appealed to the Supreme Court by the Labor Department, with the possibility that the eventual decision will clarify the situation.

The second half of the plenary session Monday afternoon was conducted by the Property Surveys Division, with Chairman Bill presiding. This session consisted of a panel discussion on "Coordination of the Federal Highway Program With the Work of the Property Surveyors." The panel members were Jack C. Burdette of the Washington District, Corps of Engineers, Washington, D. C.; Benjamin E. Beavin, President of the Baltimore firm bearing his name; Robert H. Hunter, Massachusetts Department of Public Works, Boston; and Gordon E. Ainsworth, owner of Gordon E. Ainsworth and Associates, South Deerfield, Mass.

[1] This discussion was published in condensed form in SURVEYING AND MAPPING, January–March 1958, pages 31–39, but was available, at the time of the meetings, in preprint form.

Mr. Burdette, whose background and experience is essentially a legal one, discussed "Surveying and Mapping for Federal Acquisition of Military Installations" from the point of view of one who must rely on surveys, land descriptions, and maps for the purpose of acquiring real estate for Federal purposes. He made the significant statement that his office seldom received a map or a survey from a contractor that could be used without considerable adjustment by engineers of his office, and offered many suggestions and challenging comments on how the work of the surveyor could ease the work of acquisition.

In a paper entitled "Performance and Preservation of Horizontal and Vertical Control Surveys Before, During, and After Highway Construction," Mr. Beavin described methods in use by his company on highway control surveys. One simple money-saving technique which he described was that of having contractors install brass Phillips-head screws in the masonry of all such structures as bridges, culvert headwalls, storm-water inlets, and manholes so that these could be used as permanent bench marks and traverse stations, thus eliminating the need for setting monuments except where these structures are too far apart.

Mr. Hunter described the methods in use by the Massachusetts Department of Public Works in his paper "Permanent Monumentation of Rights-of-Way and Proper Filing of Records and Notes on Control." He traced the layout of a highway from its inception, stressing the importance of bearing in mind and providing for permanent monumentation through all stages of highway construction.

Mr. Ainsworth, the final panelist, focused attention on the importance of good relations between surveyors and land owners, especially in connection with highway work. The surveyor, he said, by his actions and by his work, can often have considerable influence on whether or not his client will be able to obtain land and how much he will have to pay for it.

Following the panel discussion, President Robert H. Lyddan introduced Brother B. Austin Barry, Chairman of the Task Com-

mittee on the Status of Surveying and Mapping of the American Society of Civil Engineers, and stated that ACSM had recently assigned Victor H. Ghent to work with the group. Brother Barry reported on the status of the study, stating that the committee had not yet reached a conclusion that it would like to distribute. He explained that the primary area of uncertainty was whether or not land surveying should be considered as engineering. Based on past and present conditions alone, he said, one could easily justify the view that land surveying was not engineering; but, looking at the future, however, in which land surveying probably will involve higher-order control and much more engineering, one gets the opposite impression. All present were invited to forward their opinions and comments to the committee.

The business session of the Property Surveys Division opened with a report of the Division activities for the past year as they related to the Division Secretary's office. This report noted that the Division was continuing to act as coordinator and liaison agent for all interested surveying organizations in the country; it noted the efforts being made toward issuance of surveyor commemorative postage stamps and the Division's activities in Virginia's "Surveyors Day" held during that State's 350th Anniversary Celebration.

Following the Secretary's report, proposed revised Division By-laws were distributed, discussed, and adopted. The main revisions included the election of a Chairman, 1st Vice Chairman, and 2nd Vice Chairman, and the appointment of the Secretary and Associate Editor. Also included in the By-laws was a provision establishing Division Advisors composed of representatives from ACSM Sections and affiliates so that closer coordination between these groups can be expected in the future.

Professor Ralph Berry presented a motion requesting that the Division ask ACSM, through its Professional Status Committee, to recommend a policy and report to the ACSM Directors on the matter of the standing or status of the surveyor with respect to civil engineering.

Nominations for the 1958 officers were made and those elected were:

Chairman—A. Phillips Bill

First Vice Chairman—Professor Paul P. Rice

Second Vice Chairman—Newell B. Snow

Following the election, the meeting was adjourned and the old and new PSD Executive Committees met and appointed Victor H. Ghent as *Secretary* and Russel C. Brinker as *Associate Editor.* The Chairmen and members of the current PSD Committees were continued into the new year.

TOPOGRAPHY DIVISION

The Topography Division met on Monday, March 24, 1958, with Chairman Joe K. Bailey presiding. The theme of the session was "The Needs of Map Users and What They Expect of a Map."

Robert O. Maxson, U. S. Geological Survey, presented the first paper, "The Need for Map Use Research." Mr. Maxson stated that knowledge of present and future uses of maps is needed in order to develop map standards that will be adequate over the foreseeable future. The Geological Survey has established a Map Use Research Section for this purpose. The several series and scales of maps will be studied to determine the most desirable series range and the content and accuracy factors for each series.

"Some Aspects of Map Usage and Map User Requirements" were discussed by W. D. Hardeman, State Geologist, Tennessee Department of Conservation. From a geologist's viewpoint, the speaker stated that a topographic map should represent as nearly as possible the exact surface of the ground; contours should therefore never be smoothed. According to Mr. Hardeman, only a small percentage of the persons purchasing topographic maps from his office understand contours or have any conception of three dimensions on the maps. He pointed out that the understanding of topographic maps should be basic in our educational system with instruction given in college or high school.

Richard A. Haber, Chief Engineer, Delaware Highway Department, described "The Use of Large Scale Maps in a Highway De-

partment." The speaker outlined Delaware's public works setup, wherein the highway department has responsibility for all phases of the State's engineering and construction work. Because of the intensive use of large-scale maps and enlarged aerial photographs in activities, such as highway construction and urban development, there is a great need for close liaison between photogrammetrists and construction engineers.

In discussing "The Effects of User Requirements on Map Design," Jacob Skop, Army Map Service, pointed out that consumer research is an important factor in business and is equally applicable to the production of maps. He discussed requirements which led to the adoption of the UTM grid and standard map symbols, and described progress toward achieving a common worldwide triangulation based on a single spheroid. The User Requirements Division of the Army Map Service has been set up with the goal of supplying the user with maps that are easily interpreted, legible under varying conditions, and complete for the user's purpose.

The business portion of the session was devoted to the election of the following Topography Division officers for 1958, as proposed by the Nominating Committee:

Chairman—Page F. Hopkins
Directors—Charles H. Andregg
Elwood J. Thatcher

The Division convened again in plenary session on Wednesday, March 26. In the absence of Chairman Joe K. Bailey, who was ill, Program Chairman Milton F. Denault presided.

Julius L. Speert discussed "A New Look at the Elevation Meter." The elevation meter, a wheeled device attached to a vehicle for determining elevation differences by integrating slope and distance functions had been tried in an earlier form by the Geological Survey and found to have some shortcomings. A new model has recently been tested, with encouraging results. He reported that preliminary indications are that the instrument can save 20 percent of the cost of supplemental vertical control in areas having a road network suitable for this operation.

Herbert Johnson, Federal Civil Defense Administration, presented a paper on "The Use of Maps in Civil Defense." He outlined the structure of civil defense facilities in the United States at the National and local levels. Mr. Johnson illustrated the use of maps for the study of aiming areas, industrial concentrations, types of building construction, water systems, and other civil defense factors. He emphasized the importance of showing UTM information on all maps and stressed the need for a standard large-scale map of every urbanized area of 25,000 or more population.

Brigadier Martin Hotine, Directorate of Overseas Surveys, Surrey, England, discussed "The Emphasis on New Techniques and Imaginative Planning in the Mapping of Outlying Areas." The speaker reviewed past experience in the development of mapping methods and cited specific examples of progressive planning for surveys in remote areas.

Business Meeting

The Annual Business Meeting of ACSM was held in the Main Ballroom of the Shoreham Hotel on Tuesday, March 25, at 8:30 p.m. This meeting followed the showing of two color films illustrating the Tellurometer and its use in the field.

President Lyddan called for reports from the Chairmen of the Technical Divisions. Details of these Division reports are given in the paragraphs describing the program and activities of the respective Divisions.

A roll call of the Sections of ACSM followed. Leonard E. Cornitius, Chairman of the Texas Section, and Edgar H. Kimmons, Chairman of the North Carolina Section, brought greetings from their respective groups.

Captain Frank S. Borden, Chairman of the Membership Committee reported that, as of Dec. 31, 1957, the paid membership of ACSM was 4,067 individual and 524 library members. Since that date 384 new individual and 54 new library members have been added, giving a grand total of 5,029 as of this date. Special citations recognizing

members who had been particularly active in obtaining new members were presented to A. Phillips Bill, J. J. B. Burroughs, Edgar H. Kimmons, Emery T. Snyder, Frank A. Clemens, and Victor H. Ghent.

Captain Henry W. Hemple, Treasurer, reported that the net income from dues in 1957 was $21,428, income from sale of publications, advertisements, etc. was $13,284, making a total operating income of $34,712. Expenditures amounted to $23,540 of which $15,398 was for the preparation, printing, distribution, etc., of the Journal. Full details are given in the financial report. (*See* SURVEYING AND MAPPING, Vol. XVIII, No. 1, January–March 1958, page 110.)

Walter S. Dix, Executive Secretary, presented his annual report which is reprinted in its entirety elsewhere in this issue. (*See* page 162.)

A. C. Kalbfleisch, Chairman of the Tellers Committee, reported the following members had been elected to serve as officers:

President—Willfred B. Williams
Vice President—George C. Bestor
Directors—1958–1959 (two-year term)
Ralph Moore Berry
Duncan M. Fitchet
Jesse E. Mundine
Victor H. Ghent
Everett D. Morse

The incoming president and vice president were invited to share the platform for the remainder of the evening. After retiring President Lyddan gave his closing remarks, which are published elsewhere in this issue, (*See* page 159). Mr. Williams and Mr. Bestor spoke briefly, and President Williams adjourned the meeting.

Social Activities

EDITOR'S NOTE.—We are indebted to Mrs. Frank S. Borden for this report on the social activities of the 18th Annual Meeting.

During a week of profound scientific discussion, the lighter side of the joint meetings was in no way neglected by an able committee. A many-sided entertainment program was evolved; much of it slanted toward the visiting ladies particularly, and made so attractive that they would urge their husbands to attend these annual meetings again—and again.

On Monday morning, while the delegates were registering, a coffee hour was held for the ladies where newcomers and more seasoned visitors could meet over a cup of coffee and a light snack served by the Shoreham staff.

On the evening of this opening day the usual get-acquainted cocktail party was held for all attending the meetings, including, of course, the ladies. Many who had met in passing in the crowded corridors of the Shoreham got together in a gay, informal atmosphere. A banner crowd so enjoyed the sociability and provocative dance music that many were loath to depart.

On Tuesday a guided bus tour of Washington was open to the feminine visitors when the homes of well-known people were pointed out, as well as the celebrated landmarks of the city. The piece de resistance of the afternoon was a tea at the Chinese Embassy, a most fascinating place to visit, with its spacious grounds and colorful, oriental decor of the interior.

On Wednesday morning there was an interesting and instructive tour through the headquarters of the National Geographic Society guided by members familiar with far-flung places of the globe. A most informative movie was shown, "Operation Heartbeat," dealing with research on the heartbeat of a whale, made by the famous heart specialist, Dr. Charles Dudley White.

The really festive event of the joint sessions was the fine banquet held Wednesday evening at the Shoreham. Reservations poured in up to the last minute and additional tables had to be set up to accommodate the crowd. A cocktail party preceded the dinner and guests were in a gala mood. The food was excellent, and the entertainment following was of the highest order. A dance duo gave a very superior performance, with many novel numbers which they were called upon to repeat many times. A most amusing, as well as talented, violinist surprised and delighted her audience, not only with her expert handling of the instrument, but also with clever tricks and imitations with it. She, too, responded with

many encores. The grand finale was the fine singing of the George Washington University Traveling Troubadors, a large glee club comprising both men and women, who presented a great variety of popular and familiar numbers. Their final thrilling rendition of The Battle Hymn of the Republic was something to remember.

At the conclusion of the program door prizes were drawn—a fine relief map, a globe on a pedestal, and the latest edition of *The World Atlas*. Recipients were properly surprised and delighted. At the conclusion of each annual banquet many feel that "this was the best ever," but it seems that this year such expressions were more fervent than before!

On Thursday a luncheon was held at the Shoreham for the ladies, which almost sixty of them attended. This proved a most enjoyable occasion which featured Olga Boone as guest speaker. She is an instructor in charm classes, and her subject had the provocative title "The Art of Complaining, or Self Improvement!"

The annual Friday evening dance featured fine music and gay, bouffant dresses and was largely attended, though many of the out-of-town visitors had departed at the conclusion of the sessions.

Altogether the social program was voted "tops," and great credit is due the General Entertainment Committee which, this year, undertook its complete supervision.

Exhibits

The fourth combined ACSM-ASP exhibit was an even larger and more interesting affair than any of those preceding it. The number of exhibitors was so large that enlarged quarters for the exhibits had to be provided. This was accomplished by taking over the whole of the garage area at the Shoreham Hotel. This was an excellent move, as it concentrated all of the exhibits in one area rather than having them scattered about as in previous years. Twenty-two exhibitors each occupied from two to four contiguous booths, and some of the displays were of very great interest to a wide variety of people. Only one exhibitor failed to appear with the planned exhibit.

The commercial exhibitors taking part in the 1958 combined ACSM-ASP exhibit were as follows:

Aero Service Corporation, Philadelphia, Pa.
Air Survey Corporation, Arlington, Va.
Jack Ammann Photogrammetric Engineers, Inc., San Antonio, Texas
Ansco Division, General Aniline and Film Corp., Washington, D. C.
Askania-Werke, A. G., U.S. Branch Office, Bethesda, Md.
Bausch and Lomb Optical Company, Rochester, N. Y.
Bendix Computer Division, Bendix Aviation Corp., Los Angeles, Calif.
Berg, Hedstrom and Company, Inc., New York, N. Y.
C. L. Berger and Sons, Inc., Boston, Mass.
Canadian Applied Research, Ltd., Toronto, Canada
Decca Navigator System, Inc., & Bendix Pacific Division, Bendix Aviation Corp., Washington, D. C.
Eugene Dietzgen Company, Washington, D. C.
Direct Reproduction Corp., Brooklyn, N. Y.
E. I. DuPont de Nemours and Company, Inc., Wilmington, Del.
Eastman Kodak Company, Rochester, N. Y.
Fairchild Aerial Surveys, Inc., Los Angeles, Calif.
Fennel Instrument Corporation of America, Long Island City, N. Y.
Filotecnica Salmoiraghi, Inc., Long Island City, N. Y.
Oscar Fisher Company, Inc., Newburgh, N. Y.
Flight Research, Richmond, Va.
Geo-Optic Company, Inc., New York, N. Y.
C. P. Goerz American Optical Co., Long Island, N. Y.
W. & L. E. Gurley, Troy, N. Y.
Hastings-Raydist, Inc., Hampton, Va.
The Thos. P. Henry Company, Detroit, Mich.
Hycon Manufacturing Company, Pasadena, Calif.

THE INTRUMENT CORPORATION, Baltimore, Md.
THE KELSH INSTRUMENT CO., INC., AND WATSON ELECTRONICS ENGINEERING CO., Baltimore, Md. and Arlington, Va.
KERN INTRUMENTS, INC., White Plains, N. Y.
KEUFFEL AND ESSER COMPANY, Hoboken, N. J.
KLIMSCH AND COMPANY, Frankfurt, Germany
LOGETRONICS, INC., Alexandria, Va.
THE LUFKIN RULE COMPANY, Saginaw, Mich.
MONROE CALCULATING MACHINE CO., INC., Orange, N. J.
MONSEN TYPOGRAPHERS, INC., Chicago, Ill.
GEO. F. MUTH COMPANY, INC., Washington, D. C.
NIKON, INC., New York, N. Y.
OLD DELFT OPTICAL COMPANY, INC., Hicksville, N. J.
O. M. I. CORPORATION OF AMERICA, Alexandria, Va.
PHOTOGRAMMETRY, INC., Silver Spring, Md.
J. G. SALTZMAN, INC., New York, N. Y.
SEISMOGRAPH SERVICE CORP., Tulsa, Okla.
TELLUROMETER, INC., Washington, D. C.
EDGAR TOBIN AERIAL SURVEYS, San Antonio, Texas
UNIVERSAL INSTRUMENT CO., Brentwood, Md.
WALLACE AND TIERNAN, INC., Belleville, N. J.
WARREN-KNIGHT COMPANY, Philadelphia, Pa.
WILD HEERBRUGG INTRUMENTS, INC., Port Washington, N. Y.
ZEISS-AEROTOPOGRAPH, Munich, Germany

Educational exhibits were sponsored by the following organizations:

National Committee for the International Geophysical Year, Washington, D. C.
Exhibit of Ancient and Historical Surveying Instruments: Sponsored by the Instruments Division of the American Congress on Surveying and Mapping and Collected by Thorpe-Smith, Inc.
American Geographical Society, New York, N. Y.
Department of the Air Force
  Rome Air Development Center
  1370th Photo Mapping Group
  Aeronautical Chart and Information Center
Department of the Army
  Army Map Service
  Engineer Research and Development Laboratories
Department of Commerce
  Coast and Geodetic Survey
Department of the Interior
  Geological Survey
Department of the Navy
  Hydrographic Office
  Photographic Interpretation Center
National Geographic Society, Washington, D. C.
Special Libraries Association, Washington, D. C.

Thanks

The American Congress on Surveying and Mapping wishes to publicly express its sincere appreciation to all committee workers and participants responsible for preparing and presenting the 1958 Annual Meetings. Congratulations for the splendid and successful effort and a job well done. Thanks also to the many behind the scenes, the exhibitors, the hotel staff, the officers and members of both the American Congress on Surveying and Mapping and the American Society of Photogrammetry, and in particular to ACSM's 18th Meeting Chairman, Calvin S. Maltby and his program organization, and to the 1958 ACSM-ASP Convention Director, James P. Webb, and his able staff, for a tremendous effort and spirit of cooperation, without which the show could not have gone on.

By order of ACSM Board of Direction
March 27, 1958

A. C. S. M. in 1957*

By ROBERT H. LYDDAN

AS OUTGOING PRESIDENT, I would like to speak briefly tonight on two things. First, I would like to report on the more important things that occurred during the past year and, second, I would like to make some general observations or, if I may be so bold, to present some suggestions to the incoming President regarding important things that I believe lie ahead.

Our Membership Chairman has already reported that about 400 new members were added during the year, bringing the total of individual members to about 4,500, plus about 500 library members. Thus we continued to grow during the year.

Our Treasurer has reported similar gains during the year, so that we now have a net worth well in excess of $50,000. I would be inclined to say we are in a very comfortable position financially, if there were good reason to assume we could or should continue to operate as we have in the past. I do not think that is a wise or safe assumption, however, and will have more to say on that later.

During the year we took one tangible step regarding our physical plant—we established a modest office, centrally located in downtown Washington, aimed at providing some of our hard-working officers with suitable working space. Treasurer Hemple and Membership Chairman Borden do their work there, with the aid of some clerical assistance. With the advice of a committee appointed for the purpose, we are working toward a suitable central office facility for handling these things.

We accepted a State Department invitation to participate in a program whereby membership in technical organizations such as ours is made available to nationals in countries in which our government is sponsoring technical assistance projects. Membership dues are largely financed by the State Department.

Several weeks back, when national interest in earth satellites burst upon us, we agreed to take part in a project in which ordinary photographs of the visible satellites are to be taken from a number of places over the country. The data obtained will be used to assist in determining orbits of the satellites. The photographs are to be taken on a voluntary basis by members of the Society of Photographic Scientists and Engineers. Our part will be to assist the photographers in determining accurate geographic positions for the camera stations.

We also took part in the Surveyor's Day celebration at the College of William and Mary, which was a part of the festival commemorating the 350th anniversary of the founding of Jamestown. A very interesting historic display of surveying instruments was set up for that occasion. That collection of instruments is on display here, and in my belief is one of the best things of this kind ever done.

We have arranged to participate in a cartographic conference being organized by Rand-McNally. After the main meeting, which is to be held in Chicago, the foreign visitors are to come to Washington, at which time we plan to entertain them with a fitting social event and to help them get around to the various cartographic organizations in Washington that they are interested in visiting.

These and a number of lesser things took place during the past twelve months. In total, I would consider it an active year. Now for some observations or suggestions I would like to pass along to the new President.

I said a moment ago that I would consider we are in a very comfortable financial position *if* we should or could continue to operate as in the past. However, I believe we are moving away from the period when we can depend largely on voluntary man-

* Remarks of retiring president Robert H. Lyddan at the annual business meeting of the American Congress on Surveying and Mapping, held during the evening of March 25, 1958.

power to get all the work done. It is my belief that we should plan and move toward an organization in which more of the operational details are cared for by a paid staff.

There is nothing new in this belief; it has been mentioned by others. I hope you will not get the impression that I am advocating any radical or sudden changes. I simply think change is inevitable, and in some respects desirable, and that we should plan carefully for it. The rental of a modest central office this past year was a step in that direction.

I have talked to many leaders during the year about things we might do to put some of our money to productive use—to provide needed services to the members and the profession. The prevailing opinion is that we should make a substantial effort to build up membership in those parts of the country—and there are several of them—where there are many potential members not now acquainted with our organization. There is a considerable untapped reservoir of members in many States, and it is believed that some money spent to inform potential members regarding our organization, the journal we publish, etc., would pay good dividends in the form of additional members.

I do not believe we should be interested in increasing our membership simply for the sake of being a larger organization. What I do believe is that we could do some valuable work in certain areas if we could afford to hire some staff help, and that we need a somewhat larger organization, at our present dues rate, to make such a thing feasible.

One of the places where I believe we could well spend some money is on the secretaries of some of our Technical Divisions. To some extent the effectiveness of a Technical Division will depend on the alertness of that Division in distributing news and information. Answering the mail promptly, and seeing that timely information is distributed while still useful are the things that might be done best, as a general rule, by a secretary who is being paid for his work.

I also need to point again to the tremendous amount of work our Executive Secretary does on his own time. We broke the ice finally a couple of years ago and set up a scheme by which he is to a small degree compensated for the late hours he works. It is recognized, however, that the pay is not commensurate with the effort put in, so I urge that this matter be kept in mind for improvement when possible.

We established a new practice this year by arranging to pay the travel expenses of one of our officers while attending a series of meetings as our official representative. I am confident there will be other cases in which we should send an officer at Congress expense to attend meetings of local sections, or meetings of State organizations. I would like to see the new administration look with favor on such opportunities if they arise.

I have a feeling that ACSM is on the threshold of a period in which we should really search our minds as to what our aims are going to be and what our relations should be with State and local surveyor organizations. During the past year there have been several cases indicating that State organizations are looking to ACSM for guidance and leadership in the field of surveying and mapping. The fact that many of those organizations have policies and objectives that are in conflict with each other makes the job of deciding how ACSM can and should try to assist them a difficult one. The opportunity that ACSM will have, however, to become the national leader in these matters is very great. I urge that we accept this challenge. Move with caution, but move with firmness as rapidly as we are able to discern the wisest course for the good of the profession and the public at large.

Let me close by saying that I am humbly grateful for the opportunity you gave me to serve as your President. I regret I have accomplished so few of the things I believed possible or desirable at the beginning of the year. I owe a great debt to Secretary Dix who has, as usual, done so much of the work. I am grateful also to the other officers—to the chairmen of the Technical Divisions and the chairman of the several committees and to all the members of these hard-working groups. I think we have had a successful year—and the credit must go to the whole team.

And now, Bill Williams, it is a real pleasure for me to install you as the new President of the American Congress on Surveying and Mapping. In doing so, let me extend to you my sincere best wishes for a successful year.

C. & G. Survey to Have New Ship

A keel laying ceremony took place on March 22, 1958, at a San Diego shipyard, for what will ultimately be one of the world's finest surveying ships. The ship, which is being constructed under joint arrangements between the Coast and Geodetic Survey and the Maritime Administration, was designed and will be constructed to meet the express requirements of the Coast and Geodetic Survey. The design was prepared by the Office of Ship Construction of the Maritime Administration.

The new ship, which will be christened the *Surveyor,* is scheduled to be completed some time next year and is being built to replace its namesake which was retired in 1955 after a historic career of almost forty years. This career included episodes that are seldom experienced by peaceful surveying ships. Although the old *Surveyor* was designed for surveying the coastal waters of the United States, she was born a war baby and within a year after her launching in 1917 was responsible for damaging a German submarine while on convoy duty. This was the U-39 which sank the *Lusitania.* Even though the *Surveyor* could not leave the convoy to finish the job, the damage was just as fatal because the U-39 was compelled to enter the port of Cartagena, Spain, where she was interned. When the *Surveyor* slides down the ways of the National Steel and Shipbuilding Corporation, in San Diego, next year she will be proudly wearing the bell that was so much a part of her predecessor.

When completed, the *Surveyor* will be a two-masted, single-screw, steel ship, with a length of 292 feet; beam 46 feet; and a light displacement of 2,070 tons. Equipped with a steam-turbine that will deliver about 3,500 horsepower, the ship will have a cruising range of 10,500 miles with a 30 percent reserve of fuel. The cruising speed will be 15 knots. She will also carry three 36-foot hydrographic launches and one 36-foot landing craft, as well as several 26-foot motor whaleboats. When performing full

(Continued on page 264.)

NEW COAST AND GEODETIC SURVEY
SHIP *SURVEYOR*

The Organization and Development of A.C.S.M.

By WALTER S. DIX

EXECUTIVE SECRETARY, A.C.S.M.

MR. PRESIDENT, fellow officers, members, friends, ladies and gentlemen:

This 18th Convention of the American Congress on Surveying and Mapping finds ACSM grown to considerably greater stature and importance in matters concerned with surveying and mapping, both nationally and internationally, than in the early days of our beginnings.

I am not going to bore you with a lot of dry statistics or details you can gather from the pages of our Journal, SURVEYING AND MAPPING, as current interest; neither am I going to repeat (intentionally, at least) the facets that have already been covered, or will be, by reports and messages of other officers reporting to this meeting. Rather, in response to requests, I am going to trace briefly the history of ACSM for the record, and for information to our expanded membership—many of whom know only the vigorous ACSM of the 1950's.

Let me take you back more than twenty years—back before 1941, when this Congress on Surveying and Mapping was formally organized—and present from my own recollections and notes what I believe is a very true picture of the development of ACSM.

Few movements spring into being from a single impulse, but rather it is the varying situations and conditions that provoke men's thinking and the exchange of thoughts, that smolder and spark and finally fan into flame of action, that usually contribute to the beginnings. ACSM was no exception.

Instrument manufacturers, college educators, professional engineers, and surveyors, all were influential in the early formation of ACSM, as well as the organized groups in surveying and mapping, some of whom sponsored the formation meeting in Washington in 1941.

A very important factor in the formation of ACSM was the great national depression of the early 1930's. With the "crash" and subsequent "moratorium" came much unemployment and much time to talk and think. Private-practice groups of engineers and surveyors were broken up and their members shifted about from place to place, often at great distances, during this period, with a natural exchange of ideas and opinions. Students left college in great numbers due to lack of funds for tuition. Those just graduated faced unemployment. Such events reflect quickly to the manufacturer, and the instrument-maker was no exception. Thus, everyone, the instrument manufacturer, the (now professional) engineer or surveyor, the college professor, the college, and the student, were seriously concerned. All were thrown closely together for a time with a common problem in interest of improved conditions, with a natural and timed serious analysis of same. There was little registration in those days.

Government—Federal, State, county, municipal—also became concerned and called upon the experts mentioned above for solutions. CWA, PWA, WPA, FERA, were formed, and these great work projects required many advance operations of surveying and mapping, as well as programed survey projects in the scheme.

Further mixing of viewpoints, or the exchange of knowledge and ideas, by the mixing of professionals and educators from all fields of surveying and mapping and from all parts of our great country, quickly developed the general consensus that a closer and continued association of those in sur-

Presented at the 18th Annual Meeting of the American Congress on Surveying and Mapping, Washington, D. C., March 24–26, 1958.

veying and mapping was needed and should be maintained.

Organized committees or divisions of existing professional or technical bodies, such as the Surveying and Mapping Division of the American Society of Civil Engineers and the Committee VIII on surveying education of the parent Engineering Education group, and similar activities, naturally took the advantage when an opportunity was presented to influence and improve conditions as much as possible. The various meetings of such societies were natural meeting places to discuss the improvement of surveying and mapping.

It followed that the expanded Federal works programs created many positions and jobs for qualified persons. Monitoring such qualifications in those days before "state registration" of engineers and surveyors, made alertness the watchword for those with interest in high standards in surveying and mapping. It was natural then that those with interest in Manual No. 10 of ASCE on City Survey Standards, and those with interest in the Federal mapping and surveying specifications, would compare notes with those attempting to plan programs concerned with surveying and recruitment for same. It was just as natural that the educators were equally concerned with all salient factors involved. The college summer surveying camp became a natural meeting ground for those concerned. From such association came realization that engineers and surveyors and educators could learn much from each other and knew much that should be taught to others. The recognition of need for continued association grew stronger; then, as the opportunity for leaders in the various fields presented, the idea for forming an organization devoted to the problems of surveying and mapping developed.

It was at such a surveying camp, The Summer Surveying Camp at Rainy Lake, Minnesota, which was the summer camp of Professor Jack Dodds of Iowa State College, in the summer of 1938, that ideas crystalized into movement toward forming a national congress on surveying and mapping. This particular meeting, attended by many professors from Committee VIII, and by officials from Federal and State mapping and survey organizations, as well as by private practitioners, could well be called "a prominent mark" from which direction ACSM sprang. It would not be out of order, perhaps, to say that the birth of ACSM was envisioned by two men out rowing in a boat on Rainy Lake during that camp meeting, a surveying professor from a Kentucky school, and a WPA official from Washington, formerly with the Randall Engineers of Toledo, Ohio, who had disbanded because of the national depression. By name you know these chaps as Professor George Harding and Murray Y. Poling. Other well known names at that summer meeting, of similar influence, are: Jack Dodds, who was to be ACSM's second president; Brother Leo of Manhattan College; Professor Paul P. Rice of Rutgers; and the many others registered at that meeting, including H. M. Dibert of W. & L. E. Gurley Company.

About a year later that same group plus others met again at the Surveying Camp of the Speed Scientific School, situated in a National Park up in the hills not far from Louisville, Kentucky. Fellows like Louis Berger and W. N. Brown attended this meeting, from which further development of formation resulted. A committee was formed and in 1940, with George Harding as its chairman, was well under way to formulate a "national congress" on "surveying and mapping."

Professor Douglas S. Trowbridge was active at this time, as well as the manufacturers of surveying and engineering instruments who pledged some funds to get things started and defray early expenses of publishing a bulletin. At one such early meeting, in Washington, D. C., at the National Museum at 10th and Constitution, N.W., W. N. Brown contributed $100 to the fund. At one time $15 was the total the Congress had for operations.

A meeting was held in June 1941, at the Commerce Department Auditorium, in Washington, D. C., to discuss formation of a "congress on surveying and mapping," sponsored by several organizations of associated interest and nationally known status,

as follows: Committee on Surveying and Geodesy, Society for the Promotion of Engineering Education; Surveying and Mapping Division, American Society of Civil Engineers; American Society of Photogrammetry; and the National Geographic Society. Enthusiasm at that meeting was so great that leaders of the profession requested making the "Congress" permanent, electing officers, and adopting a constitution. Named the "National Congress on Surveying and Mapping" at first, it was changed later to "American Congress on Surveying and Mapping" to include many members from Canada and South America.

Robert Henry Randall was elected the first President of ACSM (then NCSM) with George H. Harding the first Executive Secretary.

In December 1941 the Japanese attack on Pearl Harbor plunged the United States into war.

Born on the brink of war (World War II) and nurtured through same, the management of the newly organized American Congress on Surveying and Mapping was a precarious and heartbreaking task. Its members and officers left for military service in considerable number, and those remaining, by nature of strategic occupation or profession in surveying and cartography or mapping, were fully occupied on defense matters. Nevertheless, the importance of the new organization was also immediately felt, and the nucleus forces of ACSM played an influential part in the Strategic Mapping Programs.

ACSM's Secretary, then Major George Harding, went overseas to active duty a Lt. Colonel. He was succeded by Warren T. Ellis in 1942, who also was soon to leave for active service, to be relieved in 1943 by Major Richard T. Evans, who was to remain in that office until 1946, at which time the present Executive Secretary, W. S. Dix, was appointed and Major Evans was appointed Treasurer. The first Treasurer of the Congress was Professor Thomas C. Adams of the University of Utah.

ACSM was first organized with a President, Executive Secretary, Treasurer, and 10 regional Vice Presidents. In June 1949, the Constitution was revised to the present form of organization for ACSM as indicated in the quarterly Journal SURVEYING AND MAPPING, which also lists the succession of presidents.

ACSM's new Treasurer is Captain H. W. Hemple, recently retired from the Coast and Geodetic Survey, who succeeded Major Evans in 1957. ACSM's current membership averages around 4500 to 5000, depending on periodic accounting of active status of paid-up members. This membership includes all types, individuals, libraries, sustaining, exchange, etc.

Although this is the 18th Annual Meeting of the American Congress on Surveying and Mapping, we have only had twelve presidents. The first President, Robert H. Randall, from June 1941 to May 1942, served one year; 2nd, John S. Dodds, from April 1942 to June 1943, served one year; 3rd, George D. Whitmore, from July 1943 to June 1945, served two years; 4th, Frank S. Borden, from July 1945 to June 1947, served two years; 5th, Marshall S. Wright, from July 1947 to December 1949, served two and a half years; 6th, Sol A. Bauer, 1950, served one year; 7th, Gerald FitzGerald, 1951, served one year; 8th, George H. Harding, 1952, served one year; 9th, Rear Admiral R. F. A. Studds, 1953, served one year; 10th, Carroll F. Merriam, 1954, served one year; 11th, Lester C. Higbee, 1955–1956, served two years; 12th is our present President, Robert H. Lyddan, Assistant Director, U. S. Geological Survey.

Our President-Elect is W. B. Williams for 1958.

ACSM has six divisions: Cartography, Control Surveys; Education; Instruments; Property Surveys; and Topography.

ACSM has several sections: Colorado; Great Lakes; Louisiana; Northern California; Southern California; Texas; and now St. Louis and North Carolina.

Some 30 organizations of land surveyors in various States and places are closely associated or affiliated with ACSM, which expands influential membership interest to many times more than the unit individual membership. Associated interest of the American Society of Photogrammetry al-

most doubles the ACSM's 4500 figure alone. It is conservative to estimate interest influence to more than 10,000 persons.

The first "surveyor group" to affiliate with ACSM was the Georgia Association of Registered Land Surveyors, in 1948. In 1949 the Michigan Society of Registered Land Surveyors joined, to be followed by: Virginia Association of Surveyors; Northern Virginia Chapter of VAS; Nassau-Suffolk Civil Engineers (New York State); King County, now the Washington State Association of Surveyors; Florida Engineering Society's Surveying and Mapping Division; Florida Society of Professional Land Surveyors; Eastern Massachusetts Association of Professional Engineers and Land Surveyors; Wisconsin Society of Land Surveyors; and the Indiana Society of Professional Land Surveyors.

Several other groups have taken initiative toward affiliation, often with actual completion delayed by paperwork, due to change in officers or committees or for similar reasons. These are virtual affiliates—and many of them believe they have completed the transaction, often to become surprised to learn otherwise. It is hoped the publishing of this list will shock all those into completing action.

A publication titled "Report on the First Meeting of the National Congress on Surveying and Mapping," which was the first publication of what is now the ACSM regular quarterly Journal, was printed in June 1941 to cover the organization and formation meeting, held in the United States Department of Commerce Auditorium, in Washington, D. C., June 16–18, 1941. This report chronicles those proceedings, and National Congress on Surveying Mapping Bulletin Number 1, printed in October, 1941, continued the published record of the Congress. January 1942, saw the Bulletin name changed to the Bulletin of the American Congress on Surveying and Mapping, as Vol. II and Number 1, in record. July 1944, as Vol. IV, Number 3, saw the name changed to SURVEYING AND MAPPING, Quarterly Journal of American Congress on Surveying and Mapping, which is still regularly published as such, and continues the published record of ACSM.

The roster of the attendance at the First Meeting in June 1941, lists many who have been and still are active in ACSM affairs. Several who have deceased remain in memory as active organizers of ACSM.

In those lists you will find leaders in the fields of surveying and mapping from many practices and many places. Leading private concerns were represented. Federal agencies were represented. The colleges and universities were represented. The instrument manufacturer was represented. The maker, the user, in all phases and facets, in the mutual interest became devoted to improving the science of surveying and mapping in all its branches.

Current rosters today, reflect a comparative likeness, include members from far and near places, and members from all interests in the broad encompassment of surveying and mapping.

In 1955, at the time of the 15th Annual Meeting of ACSM, the meeting was held consecutively in cooperation with the American Society of Photogrammetry, which held its 21st Annual Meeting earlier during the week. That week, March 7–11, in 1955, marked the first of the ASP–ACSM, or ACSM–ASP, consecutive meetings and co-exhibits. These have been continued through 1956, 1957, and 1958, and are again scheduled for 1959. These closely scheduled and partially combined affairs have tremendous attendance attraction, and have become recognized as the greatest shows of their class in the country today. The attendance at these annual affairs increases each year, with these larger quarters required for this 1958 show.

Now, before closing, let's summarize briefly; or perhaps more correctly, let me sum up my own observations during those twenty or more development years.

Back in 1938 it was well recognized that half of those engaged in surveying or mapping knew very little about the other half—who they were, what they did, or why they did it.

It was further evidenced in accelerated

association with one another that, besides lack of knowledge of one another or each other's field of interest, the lack of understanding continued to a considerable degree through inability to communicate with one another, to thoroughly comprehend, to be universally understood or to understand.

Some of this confusion was due to narrow limits of pertinent experience which in itself restricted the broader concepts. Some of it was due to personal or directed interpretation of words and their meanings. It mattered not a great deal whether the word was written or spoken—a single unified thought impression was seldon communicated.

History, greater than ours, and one that goes back much farther, is a fair example of such confusion, confusion deliberately designed to prevent progress by unification of ideas and accomplishment. The factor of confusion was language and its universal understanding. The example, of course, the Tower of Babel.

Here in 1958, although we have come a long way and make more effort to compare notes with one another—as evidenced by the splendid work of your committees on standards, model laws, etc., not to forget mention of the tremendous efforts of the ACSE Task Committees on Status of Surveying and Mapping—the fact remains that confusion in clear understanding still exists and the communication of viewpoints extremely difficult. The multi-meaning and multi-interpretation of words accounts for much of the confusion.

A few key words, or terms, or let us say, classifying names, in the nomenclature of surveying and mapping and related interests, are the cause of much of our trouble in clear communication—are perhaps our Tower of Babel, so to speak. Those terms are: surveying and land surveying; civil engineering; and cartography—whose definitions have been expanded and contracted through the years by normal changes in language meanings or scope, and further twisted or distorted to suit convenience or situation, so that no single or universal meaning of any term now exists. Each term nowadays means several differing areas of understanding, depending upon the user's individual understanding of the term.

In complex comparisons or analyses, it becomes as confusing as would be the use of simply X, Y, or Z in algebra under conditions where sub-identification is required for changed evaluations. Each of the terms just mentioned have broad and narrow meanings, with many localized or personalized meanings in between. It becomes imperative that same be qualified in use for proper communication for understanding. Just as we need X and X^2 or X_1 in mathematics for clear identification of meaning, we need term-meaning identification for language communication if we are to be understood or if we are to understand.

If all of you here today realize that terms do require careful qualification in argument, to be properly interpreted, or they may be misunderstood, it will be a big step in bringing the pros and contras much closer together or even dissolving differences in some instances. I have personally found avowed and declared opposites to be in actual agreement but not knowing it.

Twenty years later, from 1938 to 1958, there is still much too much confusion in communicating understandings in many vital matters concerned with surveying and mapping.

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S.A.M.E. Holds 38th Annual Meeting

The 38th Annual Meeting of the Society of American Military Engineers was held May 20–21, 1958, at Washington, D. C., and at Fort Belvoir, Va. On the 20th those registered went to Fort Belvoir for various inspections and demonstrations, a luncheon, and a business meeting. The annual dinner was held at the Mayflower Hotel in Washington that same evening. The morning session on the 21st comprised a symposium on the subject "Mobilization Planning for War." This was followed by a luncheon at the Mayflower Hotel, with the Honorable Gordon Gray as guest speaker.

Australian Investigations in Precise Altimetry

By DESMOND O'CONNOR

N.S.W. UNIVERSITY OF TECHNOLOGY

AUSTRALIA is a vast country with the bulk of the population scattered along the eastern and southeastern seaboard. It has been settled by Europeans since 1788, a mere 169 years. Nevertheless, development has been considerable, but has been made very difficult by the inability of its small population to support costly expansion. One of the major problems facing the country is the provision of adequate maps in advance of development. It appears to the author that the newly developing countries have little chance of suddenly accelerating their mapping programs beyond their present budgets, except in times of war or catastrophe. The only solution seems to be in the more widespread use of air survey. This, however, is not without its complications. Before plotting can commence, ground control surveys have to be carried out to determine heights and plan positions of certain critical points. In the author's view, the matter of ground control provides the greatest obstacle to aerial mapping in the newly developing countries. In remote areas there are no relations to level datums, and no connections with triangulation surveys. The author has considered the problem of providing vertical control, and research is being carried out at the University in the hope that a solution will be found. A review of previous work has been made (O'Connor 1957) and an experimental program carried out with the intention of comparing and evaluating the barometric methods at present in use. This paper contains the basis and results of this program to date, together with any conclusions possible at this stage. As a result of investigations described herein, and of discussions with Commonwealth Meteorological Officers, Mr. L. T. Eliel of Fairchild Aerial Surveys, and Captain Carl I. Aslakson of the Aero Service Corporation, it is hoped that an improved method of reduction will emerge, based on the plotting of datum correction curves. This will form the subject of a later publication, and references to the basis of the datum correction method are given at the end of the paper.

FIGURE 1.—Microbarometer, with leather case, ready for operation, and mounted on quick-leveling tripod.

DESCRIPTION OF THE INSTRUMENTS

The Askania microbarometer

The Askania instruments are very advanced in design, and have performed well under the wide range of field conditions experienced in these investigations. They feature optical linkages in place of the troublesome mechanical linkages of the older types.

The microbarometer, with leather case, is shown in figure 1, ready for operation. It

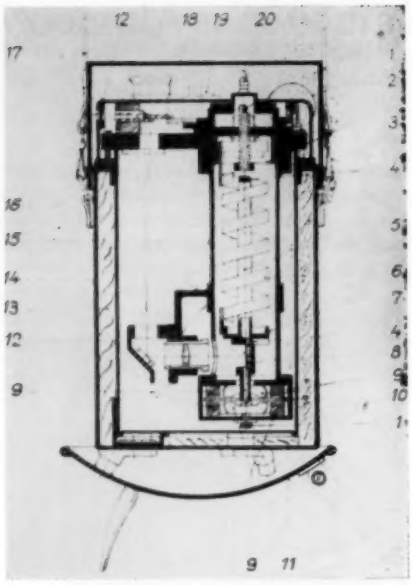

FIGURE 2.—Sectional view of microbarometer.

has three rubber feet to enable rapid leveling on a spherical base. This base, with legs folded, is carried simply attached to the instrument case. The weight of the instrument and base is 7¼ lbs., and the dimensions are 4¾″ × 7″ × 11¾″. The constructional details are shown by figures 2, 3, and 4.

The pressure element consists of a helical Bourdon tube of drawn Beryllium alloy (6). The upper end of this Bourdon tube is connected to the torsion head (3). Also attached to this torsion head, by clamps (1), is a steel wire (5). This wire is attached to the housing of the instrument at the bottom (1), and it is spring tensioned. The lower end of the Bourdon tube is connected to the steel wire (7), so that the portion of the wire between the clamps (1) and (4) is effective as a torsion bar. The suspension of the wire carries a mirror (8), and a copper disc (10) at its lower end.

The Bourdon tube is pressure sensitive, and variations in pressure cause rotational movements around the torsion bar. This rotation is transmitted to the suspension (7), and hence to the mirror (8) and the copper disc (10). This disc moves between magnets (9) to provide eddy-current damping. The amount of rotation of the suspension system as a result of pressure change is a function of the pressure change, and readings of the amount of rotation of the suspension mirror are made through an autocollimation telescope. On the suspension mirror are etched the index marks (22) 0, + 100, + 200, + 300, and these appear in the eyepiece. In the focal plane of the eyepiece is a scale (23), graduated from 0 to 100. The spacing of the index marks (22) is such that any two consecutive marks subtend 100 divisions on the eyepiece scale (23). The direct reading range is 400 divisions.

It may happen that the movement of the suspension mirror is so great that the index

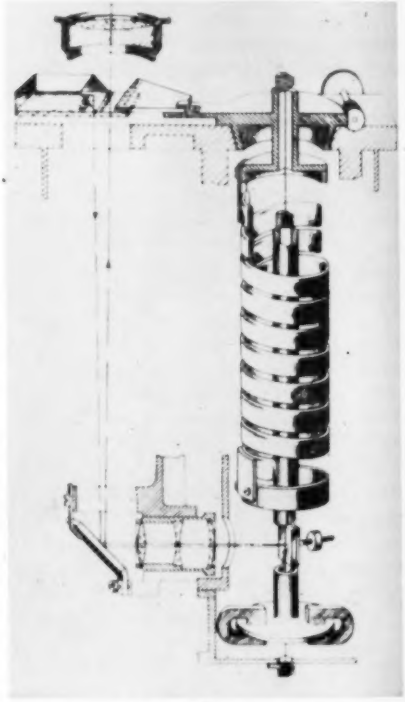

FIGURE 3.—Schematic diagram of measuring unit.

marks (22) disappear from the field of view (24). These marks may be brought back into the field of view by rotating the torsion head (3). A graduated segment (18) is attached to the torsion head, and bears a scale numbered 0 to 30 which is visible in the eyepiece through a small aperture. The rotation of the torsion head is brought about by rotation of the knob (2). The spindle (25) rotates and causes lateral movement of the spindle nut (26). Reference to figure 4 will show how the segment graduations are thus displaced with respect to the two fixed marks (21) in the small aperture of the eyepiece. Should none of the index marks (22) appear in the field of view, due to a large pressure change, the knob (2) is rotated until one of the index marks is brought back within range of the eyepiece scale. Before a reading can be taken, the nearest segment graduation must be placed symmetrically between the two fixed marks (21).

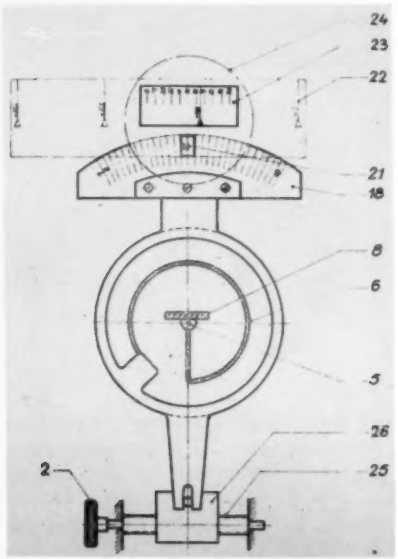

FIGURE 4.—Movable and fixed scales of microbarometer.

The measuring elements are mounted on a solid casting (15) which is suspended in the metal container (12). The whole instrument is covered with an insulating jacket (13), with an outer protecting covering of leather (14). A leather carrying strap (17) and a leather cap (16) complete the equipment.

The leveling of the instrument is not very critical, so a small circular bubble (19) is used. The three rubber feet ensure quick leveling in the spherical topped tripod (11).

Operation

The instrument is leveled on tripod with the ground glass window oriented to admit light. From the calibration table, and an approximate knowledge of the pressure, the measuring range figure on the segment (18) can be selected. This figure is set between the marks (21) by means of the knob (2) as previously described. One of the index marks (22) should now be seen against the eyepiece scale (23). The instrument temperature is taken from the attached thermometer.

Reading and Reduction

The final pressure, which is sought, is not obtained directly, but rather as the solution of the following equation:

$$P = P_R + S_E \cdot C + a(T - 293)$$

Where P is pressure sought, in Torr.

P_R is pressure for the range setting in use, in Torr.

S_E is the reading, in divisions, of the eyepiece scale.

C is the eyepiece scale value, in Torr/division.

a is the instrumental temperature correction, in Torr/Centigrade degree.

T is the instrument temperature, in degrees absolute.

P_R, C, and a are obtained from the calibration data supplied, S_E and the range setting are obtained from the field reading, and T is obtained from the attached thermometer.

1 Torr = 1 mm. of mercury at 0° C., and standard gravity, latitude 45°.

The eyepiece scale is graduated in 100 divisions, and each division represents approximately 0.1 Torr. Under good condi-

tions readings may be interpolated to 0.01 Torr. This, approximately, is the pressure change corresponding to a change of elevation of 4 inches at sea level. A reading range of approximately 40 Torr is obtained without changing the measuring range. A possible measuring range of 600 Torr lying between 300 Torr and 900 Torr is available. It must be emphasized that the microbarometer is only a relative instrument. If it is required to measure absolute pressure the instrument must be compared with a station barometer.

The Askania Microbarograph

The pressure unit is identical with that of the microbarometer, and the numbering of figure 5 can be read in conjunction with the foregoing text.

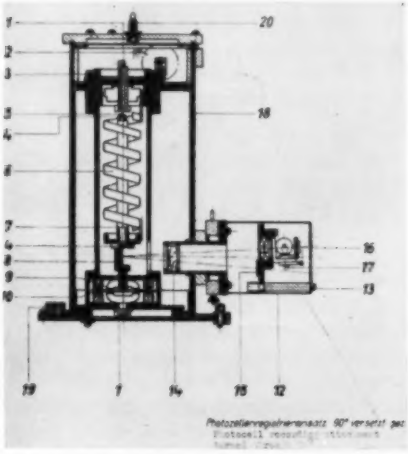

FIGURE 5.—Sectional view of pressure unit.

The pressure recording system is unique, and will be described fully. A photocell unit (15) is attached to the housing of the pressure unit (18), under a protective cap (12). A lamp illuminates a vertical slit through the objective (14), and this slit is reflected from the suspension mirror (8) onto the photocell. This photocell consists of two strips of material, and when the reflected image of the slit is symmetrically distributed with respect to the two strips, any currents are mutually absorbed. However, should a pressure change cause a rotation of the mirror, the light distribution on the strips becomes unsymmetrical, and the differential current produced is a simple function of the pressure change causing it. It is necessary to know the lamp current accurately, and the current should be constant. The sensitivity of the instrument may be changed by varying the lamp current. This is a matter of calibration.

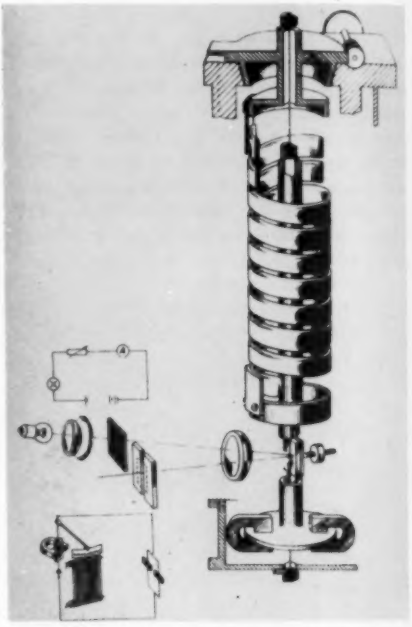

FIGURE 6.—Schematic diagram of microbarograph.

A recording instrument has to be provided, and this, conveniently, can be a micro-ammeter. A motor driven line recorder or a clockwork drop bow recorder may be used.

Operation

Before commencing operations, the light slit should be symmetrically placed with respect to the photocells. This is done by turning the knob (2) until the recording stylus is set in the center zero position on the chart. If a pressure change in any direction

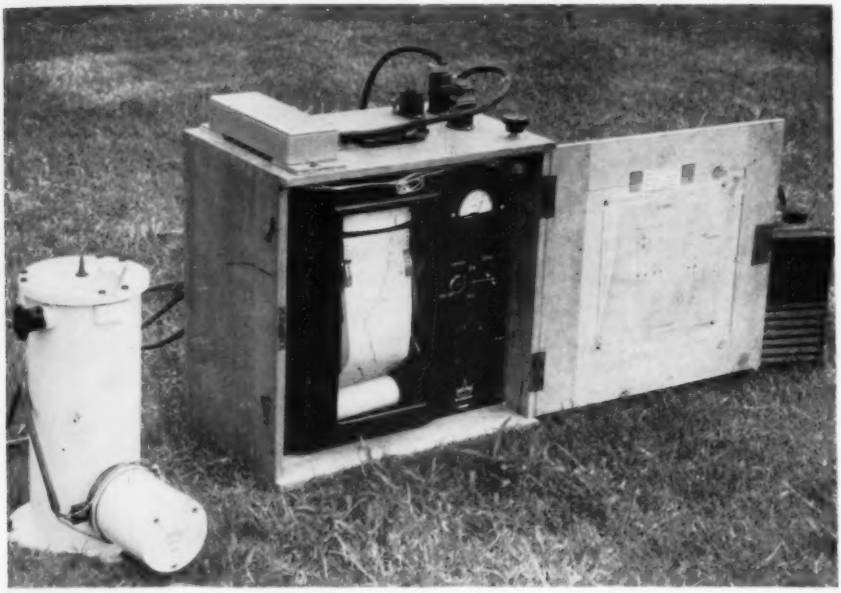

FIGURE 7.—Drop bow recording unit connected to pressure unit.

can be predicted, the stylus may be offset to allow for this. If the stylus runs off the chart it may be brought back with the knob (2), and the recording carried on. It is recommended that the instrument be switched on for about one hour before actual use.

Reading and reduction

The relationship between current and pressure is linear, and calibration is usually carried out in the laboratory with the aid of a water column, for three or four lamp currents. Typical values used are 250 Ma, 280 Ma, and 310 Ma. The higher the current, the greater the sensitivity. For example, with a lamp current of 310 Ma, the sensitivity is approximately 0.06 Torr/mm., of lateral stylus movement (approximately 16 mm./Torr), and for a current of 250 Ma the corresponding values are 0.25 Torr/mm. (4 mm./Torr). The chart ranges for these sensitivities are approximately ± 2 Torr and ± 9 Torr respectively. Concerning the reading accuracy, it is the author's experience that under fair conditions, the error in reading the chart should not exceed 0.5 mm. This would lead to errors in a pressure difference of 0.04 Torr and 0.18 Torr respectively for the sensitivities mentioned above. At sea level 1 Torr corresponds approximately to 38 feet of elevation.

The microbarograph will record changes of pressure, and, if absolute values are required, the instrument should be compared with a standard barometer. When the lamp current is known, and the calibration curves are available, the lateral travel of the recording stylus is simply converted to pressure. Two corrections must be applied to the values so obtained, one for decline of battery current and one for instrumental temperature. If it is found, after a period, that the lamp current has declined, it should be restored to its initial value and the corresponding error in pressure on the chart observed. This error is proportioned back linearly with respect to time. The instrumental temperature correction is supplied by the makers in the form of a curve.

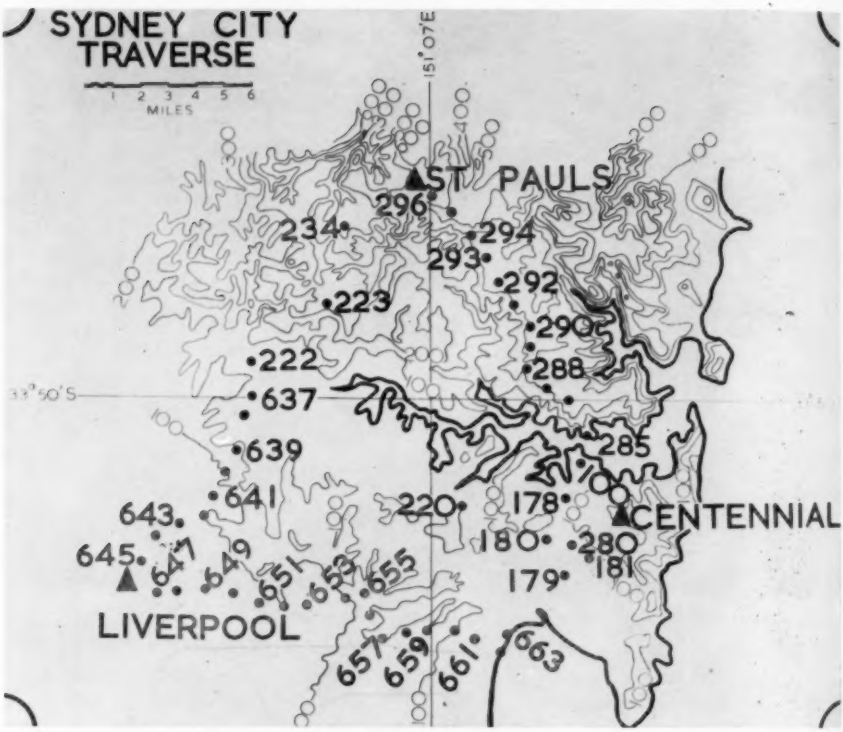

FIGURE 8.

GENERAL PRINCIPLES AND METHODS UNDERLYING THE INVESTIGATIONS

The actual computation of the height differences was carried out in the simplest manner, using the U. S. Standard Atmosphere tables and a simple temperature correction based on the assumption of an identical lapse rate in the field and standard atmospheres.

Of all the methods used the author feels that the three-base computation is the only one requiring full explanation.

The simultaneous base station pressures were obtained from the diurnal curves. A level surface passing through the St. Pauls base was considered. Next were computed the pressure readings at the points where the verticals through the other two base stations intersect this level surface. Since the distance in feet between each base and this surface was known, it was a simple matter to deduce the corresponding pressure difference from tables. This, added to the base reading, gave the pressure at the upper level, and the isobaric gradient was determined from this information. An interpolating frame, a pin jointed square frame, with parallel cotton threads, was placed over the base map, with the appropriate threads, representing isobars, over the bases. From this, the pressure at the upper level over any field station was interpolated. The difference between this pressure and the field station pressure, converted to feet, gave the difference in level between the field point and the known level surface. Hence, the level of the field point was determined.

The reduction of the instrument readings is inclined to be a little tedious, and the

preliminary drift corrections necessary to reconcile all barometer and barograph records usually takes longer than the computation of the final elevations.

A procedure of doubtful validity was adopted in the single-base reductions where the traverses were carried out on the leap-frog system. The elevations of alternate points between comparisons were obtained with different instruments. When the control charts were plotted and appropriate alternate points joined by straight lines, it was found that the two curves followed the same general trend. However, they indicated that different errors would be obtained for each point if both instruments were considered. With no theoretical justification, it was assumed that the change in error between alternate points was linear and a mean error was read off the control chart.

Humidity corrections were neglected in the interests of speed in the field and in the office.

THE FIELD TESTS

The site for the most extensive investigations was selected in the Sydney area. The numbered points shown on figure 8 are stations on the Survey Coordination network.

The stations are situated along main roads, and traveling over the area is easy. Some fifty-four stations were selected, the disposition approximating an equilateral triangle with eighteen-mile sides. Station 100 is close to the center of the City of Sydney, and the base UTI is adjacent to station 178. The topography is quite gentle, the total height range being 600 feet. The country to the south is flat, and to the north and northwest gently rising. Most of the area is covered by suburban development, but there is a tendency for the northwest to be more open.

It will be seen that only very restricted conclusions could be drawn from investigations in such easy country, although a large volume of results could be expected.

To make the tests more valuable, an expedition was organized with the help of the New South Wales Director of Mapping. The author was asked to obtain the vertical control for photogrammetric bridging of a very important run in the Dorrigo area in northeastern New South Wales. (Figure 9)

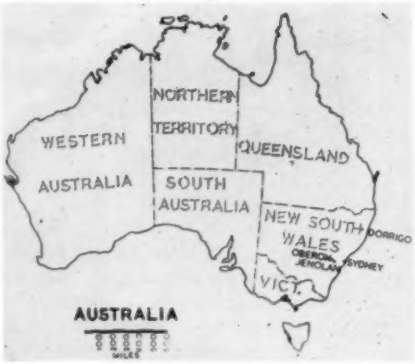

FIGURE 9.

The publication scale was to be 1:31,680, and the contour interval 50 feet. The area is covered with rain forest, and it is at an average height of 2500 feet above sea level. The area is traversed by ranges of hills of average height of 1000 feet. The weather in the area is very erratic, and there is very little access. In the author's opinion, the country is amongst the roughest in the State. It was felt that this test would be one of the most exacting that could be arranged.

While both of the above tests were being carried out, a 600-square-mile mapping project was commenced by the author at the University with the Williamson Multiplex equipment. The project was located in the Oberon-Jenolan area (figure 9), just west of the Great Dividing Range. The country is at an average height of 3500 feet above sea level, and varies from rough, mountainous, heavily timbered country in the east, to hilly and undulating, open and lightly timbered country in the west. A map was required at a scale of 1:25,000, with 25 feet contours. It was decided to obtain the vertical control for multiplex plotting by barometric means. Also, along the eastern edge, in the vicinity of Jenolan some north-south traverses were carried out to enable certain projects on hand by the Central Mapping Authority to be completed. The project will not be finished for

some time, so no detailed references are included in this paper.

THE SYDNEY CITY TRAVERSES

Fieldwork was carried out on the following dates:

December 6, 7, 1955, and

May 10, 11, 22, 23, 24, 25, 1956.

Generally speaking, the traverses were carried out in the most expeditious manner possible. The author feels that the advantage of the barometric method is the ease and rapidity with which the results may be obtained. Accordingly, most of the usual and extreme refinements in field technique and computation were cast aside in the interests of speed. The author feels obliged to draw attention to this. "Walkie-Talkie" transceivers were used in all cases where simultaneous readings were required and to ensure efficiency in movement and organization. Full use was made of motor vehicles. It was not found possible to cover the whole network in one day. Table I gives the routes of travel on the various days, as well as general information on the tests.

The weather conditions during these tests are briefly summarized below.

Dec. 6, 1955.	Clear or few clouds, moderate N.E. winds.
Dec. 7, 1955.	Clear or few clouds, gentle to moderate N.E. winds.
May 10, 1956.	Scattered cloud till mid-morning, then cloudy, light S.W. winds backing to N.E. in afternoon.
May 11, 1956.	Clear early, then overcast with fog, cloudy during day and night.
May 22, 1956.	Cloudy to overcast, light continuous rain 1530–1635, light S.W. winds until noon, then light N.W. or calm, mild.
May 23, 1956.	Cloudy to overcast, light W. to S.W. winds until 1500, then moderate W. to N.W. wind, mild.
May 24, 1956.	Few clouds to half-clouded, fine, moderate to fresh and gusty W.S.W. wind.
May 25, 1956.	Clear or scattered cloud, gentle to fresh S.W. to W. wind.

The maximum temperatures (° F) are respectively, 71, 74, 70, 72, 67, 67, 67, 68.

Considerable difficulty was experienced in deciding how to present the results. In a paper of this type, it is not possible to include a large number of control charts and other statistical devices to fully describe the mass of results. Also, it has been the author's experience that pure statistical analyses can be misleading without adequate data. The obtaining of adequate data has been one of the problems in this case, as each field test involves organization, time, and expense. Accordingly, the bulk of the results has been reduced by presenting the quadratic mean errors of the various cases. The reader will no doubt be aware of the disadvantage of the quadratic mean in that it is greatly influenced by large values. On the other hand, the distribution of the errors about zero was such that their true magnitudes would have been concealed by taking the arithmetic means. It is very difficult to allocate relative weights to observations on different days, and even at different times on the same day. Also, there appears to be no valid reason for taking the means of the columns for purposes of comparison, as each point must be considered alone.

Some pessimism may arise when Table II is inspected. The author will endeavor to bring the results into truer perspective by explanations based on control charts. In general, the author feels that the errors as tabulated are rather larger than those he would expect to obtain on any one traverse.

The following comments may help the reader in his consideration of the various methods.

No base.—These results seem to indicate that the time of the traverse was too great in view of the apparent rate of diurnal change. The errors were all negative, and it is obvious that some curvilinear method of proportioning the misclosure, based on the form of the diurnal curve, is necessary. Otherwise the time should be reduced.

Single base.—The results of December 6 and 7, 1955, do not appear to be as reliable as the others. The errors range from +32 feet to −44 feet in one case, and the distribution of the positive and negative errors is not random, but follows systematic patterns. These patterns are not the same from day

TABLE I.

Date	Starting time and station	Route	Finishing time and place	Distance Covered (miles)	Stations Observed	Average progress (m.p.h.)	Average time per station (hrs.)	Type of traverse
Dec. 6, 1955	0930, St.P.	296–285, 100, 178, 220, 637, N.E. to St.P.	1722, St.P.	40	21	5	0.38	Leapfrog.
Dec. 7, 1955	0900, 637	S.W. to Liv., E. to 633, N.E. to Cent.	1730, Cent.	35	31	4	0.27	Leapfrog.
May 10, 1956	0900, UTI.	W. to 637, N.E. to St.P., S.E. to UTI.	1300, UTI.	40	24	10	0.17	Continuous.
May 11, 1956	0900, UTI.	N.W. to St.P., S.W. to 637, E. to UTI.	1300, UTI.	40	24	10	0.17	Continuous.
May 22, 1956	0912, Liv.	N.E. to St.P., S.E. to Cent., 178, 220, 638, S.W. to Liv., E. to 654.	1530, 654	80	49	12.5	0.13	Continuous.
May 23, 1956	0919, Liv.	E. to Cent., N.W. to St.P., S.W. to Liv.	1530, Liv.	65	50	10.5	0.12	Continuous.
May 24, 1956	0920, UTI.	N.W. to St.P., S.W. to 637, E. to UTI.	1654, UTI.	40	23	5	0.33	Leapfrog.
May 25, 1956	0920, UTI.	W. to 637, N.E. to St.P., S.E. to UTI.	1600, UTI.	40	23	6	0.29	Leapfrog.

to day, and consequently the quadratic mean errors are quite large. In the case the arithmetic means would be much smaller.

Two base.—The same remarks apply. The deterioration in accuracy is obvious as one departs from the straight line joining the bases because of the three dimensional nature of the isobaric surfaces.

Three base.—This method gave better results and a better distribution than most of the others. The results of December 6, 7, 1955, cause the errors as tabulated to be larger than one might expect.

Leapfrog.—The results were good, as was expected. However, the traverses of December 6, 7, 1955, were the only ones to cover all points, those of May 24, 25, 1956 covering only the northern loop. Hence most of the southern errors are based on one value, compared with three for the others.

THE DORRIGO EXPEDITION

In the southernmost overlap of the photo run of the area, eight points had to be identified, and heights determined. One of these points was Trigonometric Station Tuting, just to the north of the main group, the others being clustered to the south at an average distance of 3½ miles from Tuting. These points were identified as follows: 1, 2, 3, 4, 5, 6, Tuting, and Tyringham. Subsidiary points on leapfrog traverses were LA, LB, LC, and LD.

It was proposed to obtain all these heights from a single base, Baker's Farm, in the vicinity of Tuting. This base was established by stadia traverse, at the foot of Tuting. However, very severe pressure disturbances made this impossible, and comparisons with known points yielded differences of the order of 200 ft.

The points 4, 3 and 2, were computed from the single base, Baker's Farm, point 2 being approximately 4½ miles from base. Three instruments were taken to each point, and read at intervals for over one hour. Comparisons indicated that these results were very reliable, the variations in height over the periods of observation being not more than a few feet. Readings were taken on points 2, 5, and 6 on another day, and the computed results seemed to indicate a

TABLE II.

Sydney City Traverses. Quadratic mean errors (ft.) (Observed—True).

Point	No Base	Single Base				Two Base			Three Base	Leap-frog
		St. Pauls.	Cent.	Liv.	U.T.I.	St.P.-L.	C-L	St.P.-C		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
100	5	4	17	4	1	5	1	23	15	12
178	6	5	8	1	5	2	2	11	10	2
181		12	1	35		35	31	1	8	9
220	3	8	4	5	4	5	4	2	2	3
221	11	3	6	1	6	1	1	7	3	5
222	27	8	7	6	11	6	6	9	7	14
223	22	8	10	6	12	6	13	6	6	13
224	21	5	10	6	11	3	9	4	4	2
St.P. 225	22		7	14	14		60			3
279		1	1	18		19	34	7	4	16
280		4	0	20		21	36	3	2	9
Cent. 282		11		22		37				7
285	10	9	12	8	6	8	9	15	15	3
286	12	3	11	5	4	2	13	12	5	13
287	19	3	11	6	8	4	16	10	6	3
288	18	5	10	6	8	5	18	9	5	5
289	17	9	11	7	10	4	19	9	6	5
290	16	2	10	10	9	5	22	9	8	3
291	20	4	9	13	11	5	24	9	4	6
292	18	4	9	14	11	5	29	9	9	4
293	17	4	9	15	9	4	34	10	5	6
294	19	3	10	16	9	6	43	9	7	6
295	23	2	9	18	12	2	55	8	1	8
296	22	1	8	19	14	1	61	4	3	3
637	20	8	6	5	9	5	6	8	9	16
638		5	6	7		7	7	7	6	16
639		9	6	14		14	10	6	11	11
640		6	4	10		9	6	4	11	15
641		8	2	13		12	10	3	8	15
642		7	8	9		8	7	8	8	17
643		7	9	2		2	4	12	2	
644		8	5	7		6	8	7	6	13
645		8	6	6		4	5	9	4	7
646		4	1	4		2	2	2	2	3
LIV.		7	6					5		6
647		9	7	3		2	1	7	10	5
648		10	4	2		2	2	7	1	0
649		11	5	4		5	5	8	6	7
650		12	5	6		7	9	9	6	5
651		10	5	7		7	8	8	8	10
652		10	3	6		6	6	5	5	4

TABLE II (continued)

Point	No Base	Single Base				Two Base			Three Base	Leap-frog
		St. Pauls.	Cent.	Liv.	U.T.I.	St.P.-L.	C-L	St.P.-C		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
653		8	3	7		8	8	5	8	11
654		6	4	9		9	7	6	7	12
655		5	6	10		9	5	7	9	15
656		5	6	11		11	8	7	10	10
657		6	4	13		14	9	6	14	12
658		4	4	14		15	9	4	12	9
659		6	4	15		17	9	2	11	9
660		5	1	20		17	9	1	11	12
661		14	9	6		0	0	8	1	
662		7	1	20		19	20	2	10	12
663		5	3	21		19	30	4	10	15
664		4	2	6		7	7	1	1	
665		3	0	18		20	36	2	5	13

barograph shift of – 12 feet, and a correction was applied. A leapfrog traverse was made along a road over the points 3, 2, LA, LB, LC, and return. Two sets of instruments were used, one of two, the other of three. The following height differences (feet) from point 3 were obtained.

Station	3	2	LA	LC	LB
Outward	0	+232	+465	+713	+868
Return	–3	+223	+462	+708	

The traverse commenced at 1509 and closed at 1858, and its length was approximately 6½ miles. The height difference between points 3 and 2 agreed exactly with that obtained from the earlier single base computation. The latter points were ¾ mile apart.

Another leapfrog traverse was run through bush from point 3 to Tyringham trigonometric station. The points were 2 miles apart, and their height difference was 1100 feet. The unclosed traverse was completed in 4½ hours, and an error of + 19 ft. was obtained.

The height of point 1 was obtained from point LB, using single base technique from LB.

CONCLUSIONS

Over the last few years, the author has had many successful experiences with barometric methods. Nevertheless, he feels that the greatest caution and judgment must be exercised when planning projects, and interpreting results. Often, without warning, an elevation will be grossly in error. This must be guarded against by a suitable field program, which should be elastic so as to accommodate any change in weather. Looking back, it would be very difficult to recommend any one method as being the best. The most successful results will emerge from the most careful combination of many of the methods mentioned in this paper. The Dorrigo expedition is a good example of this. Irrespective of the methods used, it appears that the ultimate success of a project depends almost entirely on adequate transport. In rough country, the multiple base systems are often quite useless because it is impossible to establish and visit bases economically.

All errors quoted in this paper are to the nearest foot, and the author finds it difficult to understand how greater accuracies than this can be claimed, when the number of variables is considered. From the study of the distribution of the errors over the Sydney area, the author is of the opinion that the isobaric surfaces over such areas are not uniform or regular, and consequently the

somewhat better results may occur from chance. There does not appear to be any correlation between the errors and the weather. There is little doubt that, for investigations covering a large area, superior results may be obtained by preparing an isobaric chart at an upper level from all available weather data. This method has been tested in Australia (O'Connor 1957). The author has also been developing a method in which datum correction curves are superimposed over the area, simple single base computations carried out and corrections read off. The American Society of Photogrammetry (1944) and Thompson (1954) proposed a similar method in connection with datum deformations in photogrammetry. As mentioned in the introduction, this will be the subject of a future paper.

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O'Connor, D. C.—The use of sensitive pressure devices in surveying. *Empire Survey Review*, Vol. XIV, No. 103, Jan. 1957.

Thompson, E. H.—Heights from parallax measurements. *The Photogrammetric Record*. Vol. 1, No. 4, October 1954.

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Ocean Temperature and Sea Level Anomalies on the West Coast

A Department of Commerce press release of April 24, 1958, offers a preliminary explanation by the Coast and Geodetic Survey of recent ocean temperature and sea level anomalies on the west coast of the United States. During the last few months of 1957 and the first few months of 1958, water temperatures rose sharply above monthly averages and at some stations the monthly means are the highest on record. The tide records also showed an increase in mean sea level with unusually high values during the same period.

Oceanographers in the Coast and Geodetic Survey believe both of these anomalies are directly related to a change in geostrophic winds. Surface winds in the northern hemisphere move water to the right of the wind direction. There is a prevailing north component to the geostrophic wind off our west coast. With such winds, water is moved offshore and there is a resulting upwelling of colder water moving from below to the surface to replace that which is moved away by the wind. Furthermore, there is a secondary geostrophic current parallel to the wind, caused by the heavier water near the coast and the lighter water offshore. This augments the low water temperature by bringing in a supply of cold water from farther north. Lessening the north component of the wind diminishes both upwelling and geostrophic current and results in warmer water near the coast.

Ordinarily it would require an increase in the south or west components of the wind to explain higher sea level. However, it is theorized that with a continuous condition of upwelling the water surface near the coast is always somewhat lower than that offshore. The equilibrium is upset by reduced upwelling, water near the coast seeks a level comparable to that farther out, and a rise in sea level is recorded on the coast. Thus the rise in sea level is also explained by the diminution in the north component of the wind.

The available wind data support the explanation. Furthermore, there is some evidence that north winds during the decade 1947–1956 were stronger than average and shifts in the past year may represent a return to normal conditions rather than a freak year.

The History of Surveying in the United States

(A Panel Discussion)

Surveyors' Day was celebrated at the College of William and Mary, Williamsburg, Va., on August 23, 1957, as a part of the over-all program in observance of the 350th anniversary of the founding of Jamestown in 1607. The following represents a quite complete report on the Surveyors' Day program, which had for its general theme "The History of Surveying in the United States." The program was arranged by representatives of the College of William and Mary, the American Congress on Surveying and Mapping, and the Virginia Association of Surveyors. For a preliminary report on the meeting and a complete list of the exhibits, *see* SURVEYING AND MAPPING, Vol. XVIII, No. 1, January–March 1958, pages 65–70. EDITOR

The College of William and Mary and Surveying in Early Virginia [1]

IT IS A PLEASURE to welcome you to the College of William and Mary to celebrate Surveyors' Day. For the idea of having this event, we are indebted to the genius of Dr. Earl Gregg Swem, Librarian Emeritus of the College. In making up the program we had the cooperation of representatives of the Virginia Association of Surveyors and the American Congress on Surveying and Mapping. I want to express our appreciation to those individuals[2] and to the several participants who have been good enough to come to Williamsburg in midsummer to make their contributions to Surveyors' Day. I hope that each individual here will have a pleasant and profitable visit.

Surveyors' Day is one of the many special celebrations that William and Mary is holding as a part of the College participation in the Virginia 350th Anniversary. It is especially appropriate that we recognize the Virginia Association of Surveyors at this point, for this organization had early antecedents. We find, under date of April 13, 1683, William Fitzhugh writing to Col. Richard Lee: "I presume you may have opportunity at Town [that is, Jamestown] this General court, to have the opinion of the Society of Surveyors concerning the difference of Land betwixt you and Burbudge."[3] If your Association can claim descent from that Society, then you must be the oldest association of surveyors in the country.

The purpose of my remarks is to focus attention on surveying in early Virginia, especially in so far as it concerned the College of William and Mary.

Wealth in Colonial Virginia did not mean tobacco or money: it meant land, the improvements made upon it, and the livetsock that ranged its acres. Of all records, therefore, those that testified to title in land were the most important. Obviously, the surveyors were key individuals in such a society. Grants were commonly made when a claim was certified by the county to the secretary's office in Jamestown; the patent

[1] The notes for this paper were supplied by Herbert Ganter, Archivist, College of William and Mary Library; the paper was written by Dr. J. T. Baldwin, Jr., Professor and Head, Department of Biology, College of William and Mary; and, in the absence of President Alvin Duke Chandler, the paper was read by Dr. Charles F. Marsh, Dean of the Faculty.

[2] R. V. Carter, Williamsburg, Virginia; Victor H. Ghent, Annandale, Virginia; John Marshall, Arlington, Virginia; Howard S. Rappleye, Washington, D. C.; and representatives of the College, J. T. Baldwin, Jr., and Herbert Ganter.

[3] *Virginia Magazine of History and Biography*, 1: 122–123, Oct., 1893.

was issued upon receipt of the certificate and a plot of the survey, under the condition that the land be occupied within three years. The three-year limit was first stipulated by the Virginia Company of London.

The right of others to repatent undeveloped land was the main factor in the enforcement of the three-year rule. As was to be expected, more land would often be patented than the grantee could possibly develop. If a grantee found a part of his patent occupied, he would often claim an equivalent patent elsewhere. This system was loose, inefficient, and conducive to confusion. However, the surveyor benefited from the system. The professional and ethical deficiencies of some surveyors were so serious that in time the appointment and supervision of surveyors were placed under direct control of the county court.

Lest the impression be left that all surveyors of the period were incompetent, I quote from Alexander Brown's (1890) *The Genesis of the United States:* . . . "it is certain that the Virginia Company of London, from the beginning, employed competent surveyors and posted themselves as rapidly as possible regarding the cartography of the country. . . . In 1616, when Virginia and Bermuda were under nearly the same management, surveyors and commissions it seems were sent out to both plantations, who probably made accurate surveys. No copies of the Virginia surveys have yet been found; but Richard Norwood's excellent survey of the Bermudas was engraved in 1626, and thus preserved, and this gives us the character of the men employed by the Virginia Company and the character of their work. Norwood was a man of note in his profession, and his work was excellent."

You can understand why it was that such maps were often kept secret. In the same volume just quoted from, is a map said to have been made in Virginia by a surveyor sent over in 1610 by the King of England; it was somehow procured by the Spanish Ambassador in London and sent to the King of Spain.

In the early days in Virginia there were so many counterclaims to pieces of land that the Assembly passed legislation which provided, for example, that a claimant must either compensate an occupant on his patent or must accept a fair price for his title, and that no challenge to title could be made after five years of peaceful occupation. "Trees, marked or unmarked, served to fix boundary limits, and when the insufficiency of the surveyor was added to the owner's carelessness in keeping fresh his bounds, many contentious disputes followed. Experience rarely recommended [interestingly enough] a call for the surveyor's aid, for as the Assembly of 1662 explained, 'the least variation of a compasse alters the scituation of a whole neighbourhood.' Accordingly, the law required that the county commissioners have the vestry divide each parish into a convenient number of precincts, and that in each precinct all the inhabitants should once in four years walk the bounds of every man's land for the 'preservation of friendship among neighbors'."[4] This was a happy combination of State and Church to accomplish worthy ends and to provide social occasions.

The Surveyor General was an appointee of the Governor from 1621–1624 and of the King from 1624–1693. The royal charter that established the College of William and Mary, under date of February 8, 1693, stated: "And after the said college shall be actually erected and founded, we will, that the said office of surveyor-general . . . shall be had, held, and executed, with all its profits and appurtenances above-mentioned, by the said President and masters, or professors, and their successors, for ever. [Needless to say, this eternal situation did not last.] Provided always that . . . they . . . from time to time nominate and substitute such and so many particular surveyors for the particular counties of our colony of Virginia. . . ." After 1693, accordingly, the Visitors of the College discharged the functions of the office of Surveyor General, and the faculty examined and licensed surveyors. Courses in surveying were offered at the College as recently as the 1940's.

Apparently the main reason for changing the office of surveyor general from a royal

[4] Wesley Frank Craven: *The Southern Colonies in the Seventeenth Century, 1607–1689.*

to a provincial appointment was that the surveyors were generally elected burgesses and exerted undue influence over the legislature. They, as it were, constituted a colonial pressure group.

In spite of the royal charter of the College, the Governor and Council exercised supervisory power over appointment of surveyors general and approved the appointments of county surveyors. This came about because the Governor and several members of the Council were on the Board of Visitors, and the President of the College was on the Council.

"The county surveyors were, after 1692, empowered to appoint deputies. The surveyors received their instructions from the Governor and Council. They delivered every April to the auditor a list of all surveys made during the year, with a detailed account of them. The surveyor general and also the secretary kept a record of all land surveyed. The office of surveyor general yielded about £50 a year. The surveyors were paid in fees fixed by law according to the survey made. In 1624 the fee was ten pounds of tobacco, later twenty, and by 1666 forty pounds for every 100 acres surveyed. The person for whom the survey was made paid this fee to the surveyor, who, after deducting five percent for himself, and one-sixth for the College, turned it into the office of receiver-general."[5]

The President and Masters of the College examined and licensed two surveyors who later became presidents of the United States: George Washington and Thomas Jefferson. Washington was examined in 1749, when he was seventeen years of age, and shortly thereafter was appointed surveyor for the newly created Culpepper County. Except when public duties prevented, he practiced surveying throughout his life. The faculty minutes of October 14, 1773, state that the "President and Masters unanimously agreed that Mr. Thomas Jefferson be appointed Surveyor of Albemarle & that he be allowed to have a Deputy." Indications are that he spent little time in this occupation.

[5] Percy Scott Flippin: *The Royal Government in Virginia, 1624–1775.*

In addition to the county and other surveyors that have been mentioned, special "commissioners" were appointed toward the end of the colonial period by act of Assembly to run the dividing line between certain counties or between two colonies or to survey exceptionally big tracts of land. The costs of such surveys were usually paid out of the quitrents by royal order.

A number of the William and Mary faculty, either while connected with the College or after they had resigned, were members of important surveying commissions.

Hugh Jones, Professor of Mathematics (1717–1721) and later a clergyman in Virginia and in Maryland, became about 1731 "chief mathematician" for Lord Baltimore in the boundary dispute between Maryland and Pennsylvania. Final agreement did not come until 1760, the year that Jones died. Two years later the proprietaries of the two colonies chose Charles Mason and Jeremiah Dixon to run the line which bears their names. This line was later to become famous as being in part the boundary between the free and the slave States.

Alexander Irvine, Professor of Mathematics, was with William Byrd on the Dividing Line Survey (1728) between Virginia and North Carolina. That survey was characterized by much bickering. And no wonder, for we find Virginia Commissioners writing to their counterparts in North Carolina: "It is very proper to acquaint you in what manner we intend to come provided, that so you, Gentlemen, who are appointed in this same station, may if you please do the same honor to Your government. We shall have a Tent with us and a Marquis for the convenience of ourselves and our servants. We shall be provided with as much Wine and Rum as will enable us and our men to drink every Night to the Success of the following Day, and because we understand there are many Gentiles on your frontier who never had an opportunity of being Baptised we shall have a Chaplain to make them Christians. For this Purpose we intend to rest in our Camp every Sunday that there may be leisure for so good a work.

And whosoever of your Province shall be desirous of novelty may report on Sundays to our Tent and hear a Sermon. Of this you may please give Public notice that the Charitable Intentions of this Government may meet with the happier Success."[6] This is not the only instance in which Virginians have been patronizing toward North Carolinians.

Joshua Fry, Professor of Natural History and Mathematics (1732–1737) and previously Master of the Grammar School (1729–1732) resigned after eight years affiliation with William and Mary and "retired to the back settlement to raise a fortune for his family." Thus, 220 years ago, a faculty member at the College was finding fault with his salary: surely, the complaint has a familiar ring! In 1745 Fry qualified as Surveyor for the newly created Albemarle County. Peter Jefferson—the father of Thomas—was later appointed Assistant Surveyor for the County. (Peter Jefferson's grandfather had likewise been a surveyor.) Thenceforth, Fry and Peter Jefferson were constantly associated. They were, for example, commissioned in 1749 to run a part of the Virginia-Carolina boundary line.

James Madison, President of the College (1777–1812) and Professor of Natural Philosophy and Mathematics and first Bishop of the Episcopal Church, Diocese of Virginia, was selected in 1779 to be a member of the commission to define the boundaries between Virginia and Pennsylvania. He is reported to have determined the line "with great astronomical precision." He later made surveys from which *A Map of Virginia Formed From Actual Surveys* was engraved in 1807. This map, long a standard, was known as "Madison's Map." The venerable Bishop participated in the 1807 Jamestown Bicentennial Celebration by offering, before the ruins of the old church, a prayer of national gratitude and thanksgiving. This versatile man must be numbered among the truly great individuals who have been associated with William and Mary. He, of course, belongs to the post-colonial period, but it seems appropriate that he be mentioned here.

Also even later are the "brothers Rogers," but we should recognize them briefly. Patrick Kerr Rogers was a professor at the College from 1819–1828. He had four sons who are alumni of William and Mary and who constitute a family group hardly to be excelled in the history of American science. They often collaborated to such a degree that it is sometimes difficult to discover what was whose contribution. William Barton Rogers, who later founded the Massachusetts Institute of Technology, was appointed Director of the Geological Survey of Virginia in 1835. Henry Darwin Rogers was director of the geological survey of New Jersey and likewise of Pennsylvania. The other two brothers assisted at one time or another in these surveys. In the 1858 report on the geological survey of Pennsylvania—which was possibly the most significant document on the geology of America that had appeared up to that time—Henry and William advanced noteworthy ideas regarding the structure of the Appalachians.

As mentioned earlier, one-sixth of surveyors' fees in Virginia after 1729 went to the College of William and Mary. As was to be expected, there were in time objections to this from some of the more remote parts of the Commonwealth. The inhabitants of those areas felt that the distances were too great for their sons to travel to school. Accordingly, in December of 1787, the General Assembly enacted a regulation "that the one-sixth of the surveyors' fees hereafter arising, within that part of this commonwealth called and known by the name of the Kentucky district, instead of being paid to the professors of William and Mary College, shall be paid by the surveyors thereof to the trustees of the Transylvania Seminary." This became, of course, Transylvania College. Until wrecked by the Civil War, Transylvania and Virginia were the great Southern universities. Transylvania, like William and Mary, after the war, has had a hard financial struggle. Later, in December 1787, the Assembly approved the following legislation: "Whereas the inhabitants of the counties of Harrison, Monong-

[6] William Byrd: *The Secret History of the Line.*

alia, Randolph, Ohio, are from their remote situation, deprived from the advantages arising from the establishment of seminaries in this state, it is just and reasonable that the one sixth of the fees of the surveyors of the said counties, which are now applied toward the support of William and Mary College, should be applied to the establishment of a public seminary within one of the said counties." And so Randolph Academy was established at Clarksburg and Monongalia Academy at Morgantown. The latter has grown into West Virginia University.

Thus, long before James Buchanan Duke in 1924 founded a university at Durham, North Carolina, with millions of dollars of tobacco money, under the provision that the name of old Trinity College be changed, the surveyors' fees in tobacco had supported in Virginia the College of William and Mary, Transylvania College, and the forerunner of West Virginia University.

Now, Mr. Chairman, with your permission, I would like to introduce the President of Transylvania College, an institution no longer in Virginia but in Kentucky. President Rose is a Mississippian by birth. He graduated from Transylvania in 1942 and has been affiliated with that institution ever since. He was named President in 1951. He has done graduate work at the University of London. He is an ordained minister in the Disciples of Christ Church. He will now bring us greetings from Transylvania College.

ADDRESS OF PRESIDENT ROSE

Dean Marsh, Chairman Dix, honored guests, ladies and gentlemen:

It is a genuine pleasure to have this opportunity to come and bring greetings from Transylvania College. We in Kentucky have very close ties with Virginia. In particular, Transylvania has close ties with this distinguished institution. On May 1, 1780, the Virginia Assembly, composed of many graduates of William and Mary, established Transylvania as an institution of learning, the purpose of which was promoting civilization among the pioneers. This bill was introduced by Colonel John Todd, delegate from Kentucky County, Virginia. Five of the thirteen members of the Board of Curators were members of the Virginia Assembly. Before the institution could get started five of the original members were killed by the Indians, Colonel Todd being among the five.

By 1880 some eight former students of William and Mary were members of the Board of Curators. The course of study followed closely the courses then being taught at William and Mary and were offered frequently by graduates from this institution who had come to be professors. Thomas Jefferson from the beginning had been a close counselor to Transylvania and the Board and often recommended our presidents and professors. His counsel was not readily accepted by William and Mary, however, and when the trustees refused to become a part of the scheme to move William and Mary from Willamsburg, Mr. Jefferson began to push the Legislature for a new university. He wrote to a close friend, Joseph C. Cabell, saying "Kentucky, our daughter, planted since Virginia was a distinguished state, has a university with fourteen professors and over two hundred students. If our Legislature does not heartily push our university we must send our children for education to Kentucky or Cambridge. The latter will return them to us fanatics or Tories. The former will keep them to add to their population. If, however, we are to go begging for our education I would rather it be Kentucky than any other state because she has more of the flavor of the old caste than any other."

Notwithstanding the seemingly liberal grant of twenty thousand acres of land by the State of Virginia, the laudable effort to organize education in Kentucky, although committed to some of the most prominent and energetic citizens, did not seem at first to promise success. The then unavailable condition of the lands, the unsettled and insecure state of the country, and the general necessity for attention to the ordinary duties for the preservation of life obstructed the course of classical education. The Board of Curators continued to hold their regular meetings and on June 21, 1786, resolved to apply to the General Assembly of Virginia

for one-sixth of all the surveyors' fees in the district of Kentucky which was then the perquisite of William and Mary. This request was granted in 1787 by Act of Assembly, and a further right was vested in the trustees of Transylvania to examine all candidates for the office of County Surveyor and to be the sole judge of their qualifications, and without their approbation no one could be appointed to that position. In 1790 a very stringent Act of Assembly bound those surveyors under penalties to pay this perquisite to Transylvania. The records of the trustees show that there had been received, as reported by the Committee on Funds, up to April 13, 1791, £170, 13s. 2d., an amount equal to about $567 of our present currency.

Not finding the surveyors' fees adequate, the Curators procured another Act of Assembly authorizing them to propose a lottery for the purpose of raising £500 sterling for the use of Transylvania. This scheme proved to be quite successful, and on other occasions there were advertisements announcing lotteries for an academy for Transylvania University, and on another occasion a lottery for a medical school at Transylvania University.

Transylvania is proud of her Virginia heritage and particularly those fine scholarly traditions of the graduates of William and Mary. I come this day, though late it is, expressing our official gratitude, and wishing for this distinguished institution a future as illustrious as her past. Thank you.

Thank you President Rose.[7]

It was bad enough that Virginia lost counties that went to make up the State of West Virginia and that William and Mary lost surveyors' fees that were used to found West Virginia University. But that the Board of Governors of that institution should designate the loyal alumnus of the College of Law that they did to represent West Virginia University here on Surveyors' Day is bold to say the least, for this man, during a good many years, has been busily taking land from Virginia for the Federal Government. The State thereby loses taxes; State-supported institutions, such as William and Mary, have budgets that suffer; etc. This man is a West Virginian and practiced law there. For a time he was an attorney with the U. S. Department of Agriculture, in charge of land procurement for soil conservation projects. Just prior to World War II he transferred to the War Department and handled the legal work incident to the acquisition of Camp A. P. Hill in Caroline County. His work has taken him to other parts of the country, but in Virginia he has had responsibility for the acquisition of land at Fort Eustis, Camp Pickett, Norfolk Air Base, Radford Arsenal, Fort Lee, and Camp Patrick Henry. Moreover, he initiated the taking over of property for the Kerr Dam and Reservoir. As Chief of the Real Estate Divisions of the U. S. Army Districts at Baltimore and Washington—now assigned to the Washington office to acquire land for the Army, Air Force, and Atomic Energy Commission—he is still actively taking over much territory surrounding the District of Columbia. Whether we like the results of his endeavors or not, we have to admit that he is an effective worker. It is with great respect that I introduce Mr. Jack C. Burdett, who will bring greetings from West Virginia University.

GREETINGS FROM WEST VIRGINIA UNIVERSITY

Dean Marsh, members of the panel, ladies and gentlemen:

When Dean Marsh referred to my effectiveness in appropriating the soil of Virginia for Federal use, he made me out somewhat the villain of the piece. However, that is a role to which I am accustomed, and, as I told him when he showed me his notes earlier this morning, I think his remarks are very appropriate.

In my real estate work for the Army, I am vitally concerned with surveying, and therefore deeply interested in this meeting. However, my purpose here today is not to contribute directly to the technical discussion of our subject, which, as we have seen,

[7] Shortly after President Rose appeared on this program, it was announced in the press that he had been appointed President of the University of Alabama.

is in most capable hands, but rather to bring greetings from West Virginia University, whose early history is closely related to that of the College of William and Mary, as Dean Marsh has told you, by reason of the use of surveyors' fees for the early support of both institutions.

But first, let me tell you briefly of the first surveyor who came to what is now my home town in Mason County, West Virginia, and how our local history was so vitally affected by his visit. That surveyor was George Washington, who came in 1770 to lay out several tracts of land for those who had served their Government, then seated here in Williamsburg. While there, he camped on the banks of the Ohio, at the mouth of the Great Kanawha and named the spot Point Pleasant. Four years later, on October 10, 1774, Point Pleasant was the site of a great battle between a thousand or more Virginia Riflemen, under General Andrew Lewis, and Chief Cornstalk and his Indian warriors, a battle which many historians consider to have been the first engagement of the American Revolution. Be that as it may, General Lewis' victory not only protected the lands which Washington surveyed, but opened up for development the great reaches of the Ohio Valley. We are thus reminded of the part which surveyors have invariably played in the founding and building of our Nation. For as Washington, the surveyor, was followed into my county by the soldier and the settler, so it has been throughout the land —for it was ever a surveyor who tread hard on the heels of the earliest pioneer and helped prepare for the orderly settlement of the land and the advance of civilization.

And now I would like to refer to the bond which brings me here today—the kinship between the College of William and Mary and by own school, West Virginia University. The events which formed this kinship began in 1787, as Dean Marsh has said, when it was decided to establish several Academies west of the Alleghenies. The first was Randolph, located at Clarksburg, and very soon another, Monongalia, was built at Morgantown. For the support of these Academies one-sixth of all surveyors' fees derived from the counties which they served were diverted from the income of the College of William and Mary. And so, in 1863, when the legislature of the new State of West Virginia accepted the conditions of the 1862 Congressional Land Grant Act, and set about to find a site to establish a College, it found ready for use, as the nucleus of the College, the Academy at Morgantown. Thus, from the College of William and Mary, to Randolph Academy, to Monongalia Academy, to the Land Grant College, which five years later became West Virginia University, we trace a direct line of kinship between our two great institutions.

Another, and a broader bond, of more recent vintage, but one which I sincerely feel, is my love for what the older generations of West Virginians call "East Virginia," and in particular the historic shrines of Williamsburg and her environs. I have lived within the borders of Virginia and I have known the graciousness of her people. For two centuries and a half we were a part of her Commonwealth, and our inheritance from her is great—our laws, our traditions, and, to some extent, our ways of life.

For all these reasons, it is a privilege and an honor, and it will become a permanently engraved pleasant memory, to be here today, where, so long ago, the Commonwealth of Virginia, and therefore my own State, and the College of William and Mary, and therefore my own University, had their beginnings. And so, from our University, and from its President, Dr. Irwin Stewart, and at Dr. Stewart's personal direction, I today bring you the sincerest greetings and good wishes for success in all your undertakings.

Highlights in the First Hundred Years of Surveying and Mapping and Geographical Exploration of the United States by the Federal Government 1775-1880

By HERMAN R. FRIIS

CHIEF ARCHIVIST, CARTOGRAPHIC RECORDS DIVISION, THE NATIONAL ARCHIVES

This paper was given at Williamsburg, August 23, 1957, as a part of the Surveyors' Day program. It was written to accompany the projection of nearly one hundred black-and-white and color slides. To attempt to reproduce so many illustrations is beyond our capabilities, both from a mechanical as well as a financial standpoint. To supply the reader with a knowledge of the place of the slides in the original presentation, the numbers in parentheses throughout the following pages are inserted at the appropriate places to show when the slides under discussion were first shown on the screen. Photostat and photographic reproductions of the following numbered maps and other items described in this article are available, at cost, from the Cartographic Records Division, The National Archives, G.S.A., Washington 25, D. C.: 1, 3, 4, 8–95.

—EDITOR

INTRODUCTION

(1) ". . . He does smile his face into more lines than is on the new map with the augmentation of the Indies . . ." replies Maria in William Shakespeare's *Twelfth Night*. Perhaps she was referring to this remarkable authorless "sea chart" published in London almost simultaneously with Edward Wright's *Certaine Errors in Navigation* . . . during the closing year of the sixteenth century. Wright's mathematical formulae for accurately plotting a course on this Mercator-projected map are credited with hastening the successful colonization of the New World by the English. Indeed, Captain John Smith may have utilized these mediums in his voyage for the establishment of Jamestown, the first permanent English settlement in the New World, a full 350 years ago.

(2) The London Council's instructions of 1606 required that Captain Newport, on Smith's staff, observe the terrain and explore the harbors and rivers for ". . . the council in England were ever solicitous and intent on the discovery of the South Sea." So fixed had the idea of a short water passage through the continent become in the minds of the English that colonial charters covered grants of land from sea to sea. In 1612 Smith published a description of Virginia and included with it this surprisingly accurate, though in places rather imaginative, map. As you know, Smith did not find the waterway through to the Indies. He did, however, accomplish more, for he founded a permanent settlement, a point of centrifuge for the culture that has interwoven so much of the fabric of our civilization, and his map set the pace for the surveying and mapping of a continent, which, well into the nineteenth century, was often directed towards finding a way from east to west—the passage through.

(3) During the first 175 years of colonial Anglo-America there were, of course, constant improvements in the science of surveying and mapping and in the accuracy of topographic delineation. This was especially true of the eighteenth century, as Dean Marsh has so excellently described. Much credit for this improvement is due the College of William and Mary. These improvements were made primarily in the techniques and methods of large-scale surveying and mapping of small areas and are well illustrated by this manuscript map or plan of James Read's ". . . Plantation called Lancaster in the Province of Georgia . . . in 1769." However, lack of adequate first-hand knowledge of the terrain of much of the continent, was responsible for the con-

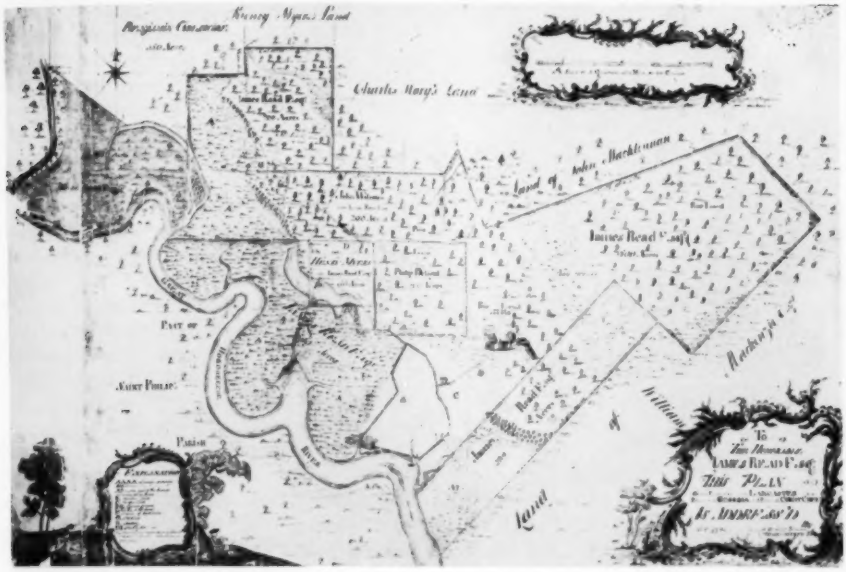

FIGURE 1.—(3) "Plan of [James Read's] Plantation call'd Lancaster in the Province of Georgia and Parish of Christ Church, . . . 23d Oct 1769 . . . by James Pargry . . ." Scale one inch to ten chains. (Dimensions 18 × 34 inches.) Manuscript map on paper. Records of the Office of the Chief of Engineers (RG 77), Map N65-4, in the National Archives.

tinued inaccurate, often hypothetical, representation of the broad physical features, far into the nineteenth century.

The part that George Washington, Bishop Madison, Thomas Jefferson, and others with training in surveying and mapping played in firming up our science in the new Republic was greater than most of us realize. Our discussion of the highlights of the first hundred years of surveying and mapping and of geographical exploration by the Federal government, quite properly begins with these men and their associates and the part they played during the struggle for Independence. These highlights of the first hundred years may be conveniently described around seven themes, each of which is illustrative of the progressive development of our science.

I

FOCUSING THE SIGHTS, 1775–1800

(4) In George Washington's diary there is an entry for June 15, 1775, which says simply that he "Dined at Burnes in the Field, Spent the Evng on a Committee." Here indeed is modesty at its best for he failed to enter what was recorded in the Papers of the Continental Congress that "The Congress then proceeded to the choice of a general, by ballot, when George Washington Esq. was unanimously elected." On June 23rd General Washington left Philadelphia for Cambridge, Massachusetts, to begin the defense of a new nation.

General Washington's knowledge of terrain, gained through his years of practical schooling in surveying, mapping, and geographical exploration, gave him full appreciation of the need of cartographic information. He was immediately and painfully aware of the nearly total paucity of this vital source of intelligence. Repeatedly he implored the Congress for assistance in finding qualified personnel, and he admonished it for lack of funds to hire good men.

In his letter to the President of Congress on December 31, 1775, he noted that ". . . Before I quit this Subject I must remark, that the pay of the Assistant Engineers is very small, that we cannot expect Men of Science will engage in it, . . ."

By the spring of 1776 he was able to report in his letter from New York to a Committee of Congress that ". . . I accordingly have the Pleasure to enclose you Colonel Gridley's report of the Harbour and Works of New London, with the several Plans he has taken, which appears to be accurate and well done . . ."

This record among the papers of the Continental Congress in the National Archives is one of the earliest official maps of the Federal Government.

(5) As Governor of Virginia during the Revolutionary War, Thomas Jefferson received, collated, and interpreted much intelligence about the British, French, and American forces. He sometimes reduced this information to map form for use by appropriate bodies. An example of this is his "Map of Gwynn's Island and Vicinity at the mouth of the Rappahannock River" prepared sometime during June or July 1776.

On November 6, 1776, after nearly seventeen months in the field, General Washington's topographic corps was still carried in his pocket. In a letter of that date to John Augustine Washington he said: "It is not in my power to furnish you with so extensive a Draft as you require, and I have none but printed Maps of the Country you want to see delineated, and have no person about me that has time enough to copy one, but a rough sketch of the Country to wch. we have been Manouvering, and which I had taken off to carry in my pocket, I enclose you as it will afford some Idea of the parts adjacent to New York."

On January 25, 1777, General Washington again requested that Congress authorize him to establish a central mapping corps because "The want of accurate Maps of the Country which has hitherto been the Scene of War, has been of great disadvantage to me . . ."

(6) More than two years had elapsed since Washington entered upon his duties before the Congress authorized him to employ and attach to his staff personnel qualified to make maps. On July 25, 1777, the Continental Congress resolved: "That General Washington be empowered to appoint Mr. Robert Erskine, or any other person that he may think proper, geographer and surveyor of the roads, to take sketches of the country, the seat of war, and to have the procuring, governing and paying the guides employed under him, . . ."

In this resolution is perhaps the first official authorization by the Federal government of a mapping agency, that is, a geographer-surveyor and assistants to Washington's headquarters staff. Robert Erskine accepted the position and entered upon his duties on July 27, 1777. From his able surveys there issued more than 130 different manuscript maps, one of which "A Map of the States of New York and New Jersey . . ." is shown here. Washington used and annotated this and most of these maps for or during his campaigns. During his three years as Geographer and Surveyor General to the Continental Army, Erskine built up a small corps of surveyors, among whom Simeon DeWitt, his successor on December 15, 1780, was perhaps the most famous.

(7) James Broom's map of the battlefield of the Brandywine, on August 27, 1777, is an example of a simple planimetric-type map Washington received from his surveyor-scouts as intelligence information. This is essentially a map of roads and distances.

(8) General Washington was aware of the need of attaching a geographer-surveyor to his Southern Army and, after considerable negotiation, on July 11, 1781, obtained the services of Thomas Hutchins, a former British Officer of considerable cartographic skills, who had espoused the patriot cause and had offered his services. Thomas Hutchins was to play a leading role in establishing the first peacetime mapping agency of the Federal government, the General Land Office. This is Hutchins' reply accepting the position and noting his requirements.

(9) The famous French engineer officer

Louis Lebéque Duportail and several of his colleagues offered their services to the American cause and in July 1777 were commissioned by the Congress to assist Washington in engineering works and mapping. One of them, Lieutenant Colonel Jean Baptiste Gouvion, was present at the seige and surrender of Cornwallis at Yorktown in October 1781. He prepared this manuscript topographic map showing the order of battle and sent it to General Washington, who transmitted it to the Continental Congress. This, perhaps the first official map of the surrender, was lost until some fifteen years ago when it was discovered among the records of the State Department in the National Archives.

(10) When the American and British Commissioners were deliberating in Paris in 1782 and 1783 and searching for an amicable cessation to hostilities, they were continuously aware of the total lack of accurate maps of North America upon which to determine the boundaries of the independent United States and the British Dominions. They generally agreed on one map as the best source. This was John Mitchell's eight-sheet 1:2,000,000 scale "Map of the British Colonies in North America with Roads, Distances, Limits, and Extent of Settlements . . ." first published in London on February 13, 1755. John Mitchell, a botanist and medic, emigrated to America about 1725, lived in Urbanna, some thirty miles north of Williamsburg, Virginia, and then, in 1746, returned to England. Shortly after his return he was commissioned by the Board of Trade to compile the aforementioned map, which some historians consider the most important map in American history. On April 8, 1790, Benjamin Franklin sent this, his sheet of the Mitchell map, to the Secretary of State with a letter saying that on it the boundary between Canada and the United States was traced in pencil. Eight days later Benjamin Franklin died.

(11) But what were the boundaries of this new Nation? Lacking accurate maps, they were at best mostly conjecture. Among the Papers of the Continental Congress is this example of the lack of accuracy of information about the West. This authorless map purports to show that "by our mistake in the Mississippi we are loosing a vast rich country for not claiming it in time and the sketch is to give an Idea of it."

You will note, however, that the compiler has mistakenly, or intentionally, identified the Mississippi as the Missouri River, an error quite common during this period.

(12) During the first twenty years of the Federal period much time was spent in surveying the boundaries between the States and the lands in the New West. Surveyors also were called upon to measure and map the lands acquired by the rapidly expanding population in the eastern States. An example of such a colonial-type survey is a "Map of Stephen Moore's Lands at West Point on the Hudson River in October 1783." This pattern of so-called indiscriminate survey is representative of much of the form of land measurement in the thirteen original colonies and stands out in sharp contrast to the (13) rectangular township-range subdivision of that vast area of the new nation set aside or ceded by the thirteen States as the public domain for "conversion from a wilderness to salable parcels of property." This remarkable plan of subdivision of the public domain, attributed to Jefferson and Williamson, was adopted by the Continental Congress as the Land Ordinance on May 20, 1785. The plan or system was first applied by Thomas Hutchins who in 1785 was appointed Chief Geographer of the United States to begin the land surveys in an area called the Seven Ranges in eastern Ohio.

(14) The cartographic products of these surveys is illustrated by this plat of Township 3 North of the Second Range in eastern Ohio compiled from the field notes of Absalom Martin in 1786. From this Land Ordnance there evolved and was officially created on April 25, 1812, the General Land Office, now the Bureau of Land Management, the oldest continuous mapping agency in the Federal government. Its contributions to effecting standards of land measurement and its subdivision of the vast public domain into salable parcels of land for ac-

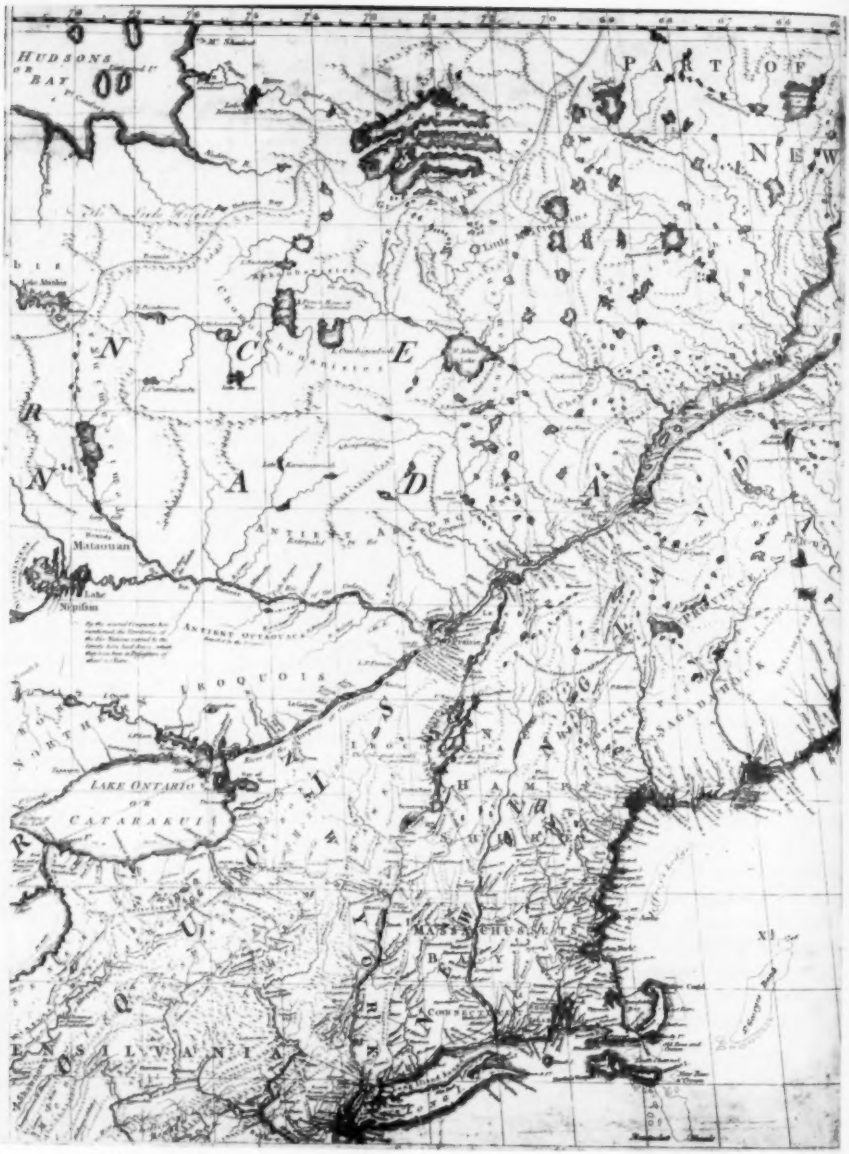

FIGURE 2.—(10) One sheet of John Mitchell's eight-sheet 1:2,000,000 scale "Map of the British and French Dominions in North America with Roads, Distances, Limits, and Extent of Settlements . . .," first published in London in 1755. (Dimensions 22½ × 28½ inches.) Records of Boundary and Claims Commissions and Arbitrations (RG 76), in the National Archives. This published (printed) map bears the annotation "Dr [Benjamin] Franklin, East n boundy."

quisition by a seemingly endless flood of settlers, is a story of mapping on a grand scale.

(15) Short of money but land rich, the new government often paid off its debts in lands. This plat and description among the records of the General Land Office covers a large tract of land in Ohio surveyed for Ebenezer Zane who had blazed trails and roads for the Federal government.

(16) Philanthropic societies, refugee groups, religious organizations, and similar bands of people sought to obtain grants of land to settle in the New World. Here is a plat covering a portion of the lands in southeastern Ohio, granted to refugees from Canada and Nova Scotia in the 1790's.

(17) The Congress and the President of the new Nation were confronted by numerous problems, many of which pertained to land acquisition and disposal; the rectification and running of State and local district boundaries; the construction of public works, such as roads, canals, and harbors; and the fortification of strategic sites such as is shown on this 1798 map and plan of Fort Nelson on the Elizabeth River, in Virginia. These programs and many others required surveyors and cartographers.

(18) During the 1790's the President and Congress prepared to move the capital of the United States from Philadelphia to the multiterraced, marsh-fringed triangle of land between the Potomac and Anacostia Rivers.

Andrew Ellicott, a leading surveyor of State and Federal boundaries, was commissioned in 1792 to survey the exterior ten-mile-square boundary of the Territory of Columbia and in 1793 compiled this, the first, large-scale topographic map of the Nation's Capital.

II

SKETCHING IN THE BROAD PHYSICAL FEATURES: 1800–1817

When the Capital of the United States was officially moved from Philadelphia to its fall-line site on the Potomac River in 1800, its strategic location on the natural waterway to the Ohio valley was emphasized. Canalization of the river to its headwaters near the Ohio watershed was contemplated.

(19) In 1803 surveys were under way to plan for canalization. An excellent example of the cartographic products and form of presentation of such surveys is the large-scale map of a proposed canal around Harpers Ferry by Nicholas King and John Harbaugh, top surveyors and cartographers of this period. This manuscript map among the records of the Office of the Chief of Engineers in the National Archives is illustrative of the better quality of maps that the War Department, lacking a permanent topographic bureau prior to 1819, had prepared on contract by civilian surveyors, cartographers, and draftsmen.

(20) Thomas Jefferson, President of the United States (1801–1809), was by training, intellect, and personality the right person in the right place when this country's expansion to the Pacific coast came up for decision. When he was a pupil of the Reverend James Maury in the Walker parish school in Albemarle County, Jefferson was shown a map of North America and on it the route of the mythical waterway through the continent was indicated. As the years sped by and Jefferson's desire to have the West explored and mapped for this waterway, and to have the area acquired for the United States, burned ever deeper. On the eve of the Louisiana Purchase in 1803, President Jefferson set in motion a succession of geographical explorations and surveys that were largely responsible for securing to the United States the country to the Pacific coast. Perhaps the most significant of these was the Lewis and Clark expedition to the Pacific Ocean and return to St. Louis in 1803–1806. The manuscript map we see here is Nicholas King's compilation from notes and maps Lewis and Clark sent down the Missouri River from their winter camp near the Mandan village at the Great Bend in April 1805. King compiled this map in Washington for the Secretary of War. It shows what Lewis and Clark concluded on the basis of Indian and travelers' information were the principal rivers and mountains. The wealth of data

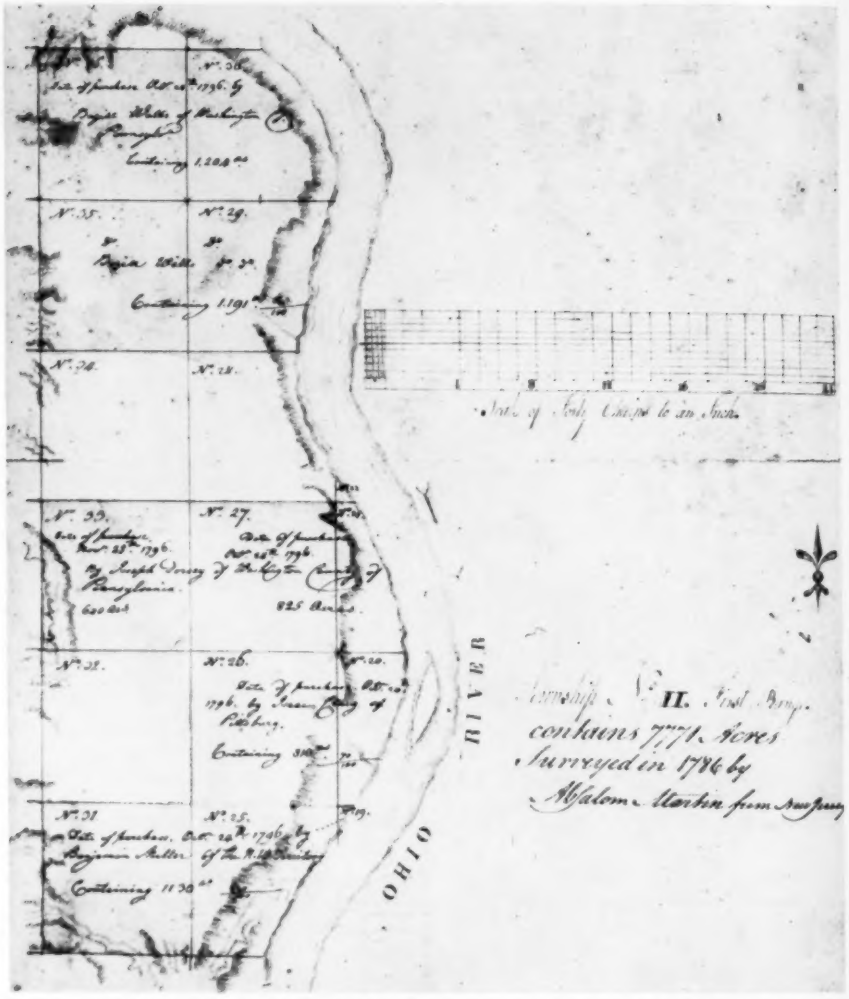

FIGURE 3.—(14) Plat of "Township No. II. First Range . . . Surveyed in 1786 by Absalom Martin from New Jersey." Scale one inch to ½ mile. (Dimensions 20 × 16½ inches.) Manuscript map on paper. Records of the Bureau of Land Management (General Land Office), Survey of the Seven Ranges (RG 49), in the National Archives.

on natural history and geographic features, and the survey field notes and maps prepared by Lewis and Clark, opened the West to detailed exploration—a transcontinental route had been discovered, but it was too far north.

(21) During the period of his presidency Jefferson pressed for the exploration and mapping of the trans-Mississippi West. One of the most significant explorations was Lieutenant Zebulon Montgomery Pike's expedition of 1805–1806, from St. Louis up

FIGURE 4.—(21) One of four sheets of "A Sketch of the Mississippi from the Town of St. Louis to its source in Upper Red Cedar Lake, . . . Taken from the notes of Lieutenant Zebulon Montgomery Pike . . . pending the years 1805 and 1806, . . . By Anthony Nau." Scale ten miles to an inch. (Dimensions 39 × 32 inches) Manuscript map on paper. Records of the Office of the Chief of Engineers (RG 77), M34, in the National Archives.

the Mississippi River to search for its headwaters. He did not find the headwaters but the map and journal of his route are landmarks in the history of exploration. Here we see one of four sheets comprising the manuscript map compiled by Anthony Nau from Pike's survey field notes and maps.

(22) On July 15, 1806, Pike, with twenty men, was ordered to proceed southwestward from St. Louis toward Santa Fe, New Mexico, on an exploring expedition. Pike and his party discovered and described many new features, especially in the Great Plains at the foot of the Rocky Mountains. The party was captured by the Spaniards and imprisoned in Mexico for a short time, and their field notes were confiscated. In Pike's field notes, returned to the United States by

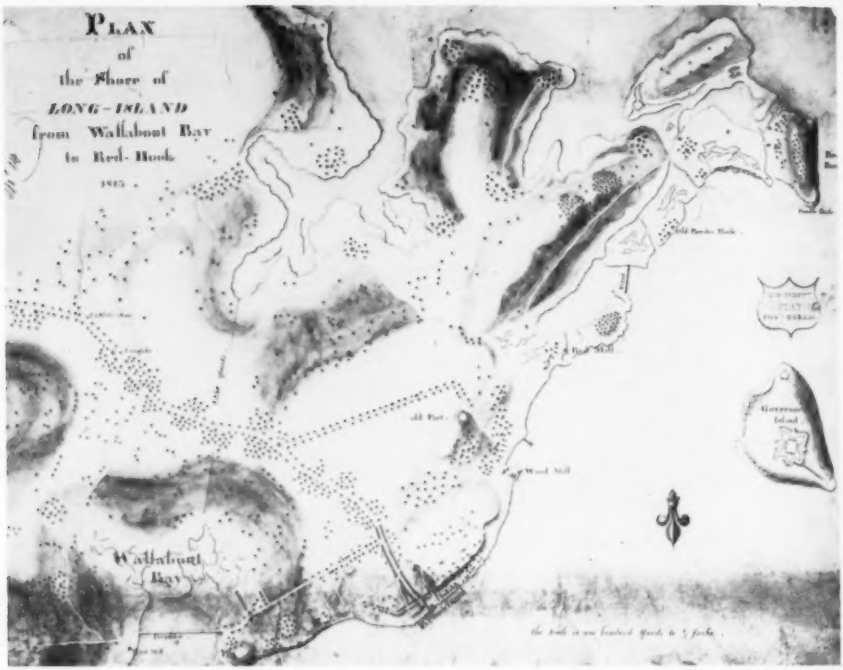

FIGURE 5.—(24) "Plan of the Shore of Long-Island from Wallabout to Red-Hook [N. Y.] 1813 . . . [by] Joseph Mangin." Scale 200 yards to an inch. (Dimensions 21 × 27 inches.) Manuscript map on paper. Records of the Office of the Chief of Engineers (RG 77), D26, in the National Archives.

Mexico in the early 1900's, is this crude map, Pike's sketch of his route along the base of the Rocky Mountains. At the bottom middle of the slide is Pike's sketch of the loftiest mountain, Pike's Peak.

(23) The increasingly large number of settlers moving into the Old Northwest territory of the Great Lakes shortly after 1800, found the Ohio River a quick and easy route west—that is, as far as the obstructions at the Falls of the Ohio just below Cincinnati. In the early 1800's Albert Gallatin, Secretary of the Treasury, was authorized to prepare a comprehensive appraisal of the subject of internal improvements, especially as to roads, canals, and harbors. In his historic report of 1808, is a copy of this manuscript map on parchment by J. Brooks, showing the Falls of the Ohio and the proposed improvements.

(24) In the period between the Revolutionary War and the War of 1812, the status of surveying and mapping in the country advanced appreciably, though the War Department still was without a permanent nucleus of professional topographical engineers. During the War of 1812, much of the mapping and map compilation was done by civilians under contract to the Federal government. In this and several succeeding slides is evidence of these advances. On this slide is shown a portion of a map covering part of present-day Brooklyn (then Brookland), New York. Relief is shown by color tint, and roads, trees, and houses by conventional symbols standard for the period. (25) This large-scale map of Governor's Island in New York Harbor illustrates the use of color in shading and in giving a third-dimension look as well as

distinguishing details of culture. (26) One of the most beautiful examples of the painstaking attention given to cartographic details, especially trees and their shadows, is this half portion of a "Chart Illustrative of the Siege and Defence of Fort Erie in 1812."

(27) In this so-called "Survey of the Countries South West of Lake Huron" by one Stephenson, under William Tatham, we have evidence of a very amateurish, even misleading, map. Among the records of the Office of the Chief of Engineers are this map and certain others like it that were prepared under contract by a young civilian and apprentice draftsman, whose efforts were more from imagination than direction. (28) The "Survey of the . . . River St. John . . . by William Tatham on August 21, 1812" is one of many maps prepared or acquired by William Tatham, confidante of Washington, Madison, and Jefferson, jack-of-all-trades and master of some, and owner of probably the largest collection of manuscript and printed maps of North America in the United States prior to 1819. Repeatedly he tried to sell this collection to the Federal government but failed. In his later years he was given a job as keeper of the U. S. Arsenal in Richmond. Obituary reports note that in his home the rooms bulged with maps, books, and documents. Depressed because he felt his government had abandoned him and his records, he stepped in front of a cannon as it was fired in celebration of February 22, 1819, and was blown to bits. What has happened to his valuable map collection?

(29) The War of 1812 emphasized the considerable shortcomings of the Federal government in adequate maps, especially of the approaches to the Nation's capital. As a result, the War Department, between 1814 and 1819, appointed and convened several boards of officers and civilians to prepare, on the basis of field survey, large-scale planimetric and topographic maps. This portion of a manuscript map of the vicinity of Norfolk in 1817 is a good example of the planimetric maps that were compiled.

(30) When the General Land Office extended its rectangular township grid pattern of surveys into a region of prior surveys, it must of course preserve both. Here we see a portion of a General Land Office map of part of Louisiana showing the French and the American land-survey systems.

(31) One of the primary programs of the War Department, shortly after the War of 1812, was to survey and map the major waterways of the country. Major Stephen H. Long, a skillful engineer and surveyor, in 1815 and 1816, conducted extensive topographic reconnaissances which resulted in a remarkable large-scale, ten-sheet map of the northwestern quadrant of the United States. Here is half of a sheet covering the confluence of the Missouri and Mississippi Rivers. It is said that Long did much of his water reconnaissance by steamboat.

III

RECONNAISSANCE EXPLORATION AND MAPPING FOR INTERNAL IMPROVEMENTS AND THE RAPID SETTLEMENT OF THE MISSISSIPPI BASIN: 1817–1838

(32) The opening years of this period were auspicious for the field of surveying and mapping and geographical exploration. In 1817 John C. Calhoun became Secretary of War and almost immediately established West Point as an academy for training army officers, especially in engineering. The following year Calhoun reorganized the War Department and added a centralized topographical unit under the eminent topographical engineer Major Isaac Roberdeau. By these acts and out of national interests he revived the Army's responsibilities in the exploration of the West. In the Military Academy at West Point, its Superintendent, Sylvanus Thayer, inaugurated a comprehensive course of instruction in military and topographical engineering. One of his first and outstanding pupils was George W. Whistler, father of the famous portrait painter, James Albert McNeill Whistler. Cadet Whistler's unmistakably great talents were expressed in this colored manuscript map of West Point in 1818.

(33) Shortly after his graduation from West Point, Lieutenant Whistler was detailed with Lieutenant McNeill to make topographical surveys in New England. Comparison of the relative values of the

contour and the hachure in showing relief was brought out by these two lieutenants in this large-scale map of Salem Neck in Massachusetts in 1820.

(34) Among the records of the Office of the Chief of Engineers in the National Archives are large-scale detailed maps indicating that in the 1820's the topographical engineers had advanced quite far in the use of bathymetric tints, submarine and terrestrial contours, and topographical representation. Here is a portion of a map of St. Andrews Sound in Florida completed and drawn from surveys by Lieutenant A. Canfield in 1826.

(35) The use of color and bathymetric tints to bring out the third dimension is well illustrated in this chart of "Annapolis Harbour Roads [Maryland] Surveyed by Jonathan W. Sherburne, U. S. Navy in 1818" for the Board of Commissioners investigating the defenses of the Atlantic Coast.

(36) Shortly after his appointment as head of the Topographical Bureau, Major Isaac Roberdeau compiled two valuable maps for the Board of Commissioners as a kind of backdrop for planning for internal improvements and exploration. This map of western North America shows the status of knowledge then available and reveals much that is wanting. (37) This map of the eastern half of the United States shows a much higher degree of accuracy and knowledge of the broad physical features. The principal roads and towns are plotted.

(38) In 1818 Secretary of War Calhoun revived the Army's professional interest in the West by authorizing an exploring expedition under Major Stephen H. Long, which, patterned after that of Lewis and Clark, was to ascend the Missouri and Yellowstone Rivers and establish new posts along the way. However, the Panic of 1819 curbed the primary objectives, though the High Plains were traversed and the Platte River was explored in search of the headwaters of the Red River. This expedition, which included both scientists and military personnel, ascended the Missouri River to Old Council Bluffs in a steamboat. Much valuable scientific information was acquired and Major Long prepared a remarkable map of the trans-Mississippi Basin, the northwest quadrant of which is shown on this slide.

(39) The President of the United States in 1825 commissioned John C. Brown, a civilian surveyor, to explore, mark, and map the "Santa Fé Road" from the western frontier of Missouri to San Fernando de Taos near Santa Fe in New Mexico. His line survey, run in 1825–1827, was made with a chain and compass, corrected by observations for latitude with a good sextant. Two large-scale maps and a detailed field notebook were completed for the Government. We see here two adjoining sheets of his notebook of this, the first large-scale survey across the Plains to New Mexico.

(40) The search for the headwaters of the Mississippi River, initiated by Lieutenant Pike in 1805, was successfully concluded by Lieutenant J. Allen attached to the exploring expedition of Henry Schoolcraft in 1832. Allen mapped the headwaters in considerable detail ". . . delineating in his fieldbook all the bends of the river precisely as they occurred . . ." He compiled this composite manuscript map on a scale of 5.75 miles to one inch.

(41) The Survey Act of 1824 set in motion a wide variety and number of projects for internal improvements by the Topographical Bureau. These improvements covered rivers, canals, harbors, railroads and roads, arteries for transport so vital to a rapidly expanding and moving population. One of the most important of these were the extensive surveys in the 1820's for a grand canal connecting the head of Chesapeake Bay with the Ohio River by way of the Potomac. Here is a portion of one of the survey sheets which shows the proposed and alternate routes through the National Capital. Surveys had barely been completed when the Baltimore and Ohio Railroad extended its track from Baltimore to Washington to eclipse the canal project.

(42) In the 1820's and 1830's an increasing number of settlers moved out of New York and Pennsylvania to settle the shores

of Lakes Erie and Ontario. A clamor rose for improved harbor facilities. An excellent example of the topographical detail of the maps prepared from the surveys is this chart of Sandusky Bay, Ohio, in 1826.

(43) The rapid increase in the settlement of the tidewater and piedmont areas of the southern States and the proposals for a canal across the neck of Florida, during the first several decades of the nineteenth century, raised demands for surveys and improvements in these regions. These demands were met by the government in extensive plans and surveys for roads, railroads, and harbor improvements such as are shown on this map. (44) The Topographical Bureau acquired maps from various sources and often made copies of them for use in connection with plans for detailed field surveys. Here is a copy of Charles Vignoles' map of Saint John's River, Florida, drawn in 1822.

(45) The principal road across which many thousands of emigrants traveled during the first half of the nineteenth century was the so-called United States or National Road from Cumberland, Maryland, to Vandalia, Illinois, and beyond by alternate routes to St. Louis. As early as 1800 the eastern segment was fixed and Jefferson envisioned it as the great artery of western travel which it became. Here is shown a portion of a map of the route in the vicinity of Washington, Pennsylvania, in 1821.

(46) The Nation's capital did not escape the loud cry for improvements of transport facilities. On this plat is shown the proposed change in the line of the canal which, in 1822, extended across the east end of the Mall in front of the Capitol Building. You will note that President James Monroe approved this plan.

(47) Settlement of the western lands was accelerated and encouraged by public works and by free enterprise. The Federal government granted alternate squares of land checkerboard fashion, in the bands of varying widths astride waterways, to canal building companies as an inducement to build. Here we see a General Land Office map with such a pattern of grants to the Wabash and Erie Canal Company in the area vicinal to Toledo in 1833. Andrew Jackson, as President of the United States, approved this plat.

IV

THE COUNTRY IS MEASURED TO THE PACIFIC OCEAN: 1838–1849

(48) In 1838 the Topographical Bureau was given wide authority in surveying and mapping activities. The first major survey after this reorganization was by a civilian scientist, a brilliant French topographer, one Joseph N. Nicollet, who had come to the southern part of the United States in the late 1830's. Here he established astronomic fixes and triangulation base points for his map of the area. He was the first person to use the barometer in ascertaining the altitude of points in the interior of North America. His work so impressed Colonel John J. Abert, Head of the Topographical Bureau, that in 1838 he was commissioned to survey the "Hydrographical Basin of the Upper Mississippi River." In this remarkable achievement in 1838 and 1839, Nicollet had as his interested and valued assistant, Lieutenant John C. Fremont. The field results were used in compiling two large-scale maps of the region, a small portion of one of which is shown here. Note how he sketched in the form lines for hachuring.

(49) In the spring of 1839, the eminent geologist Dr. David Dale Owen of New Harmony, Indiana, was commissioned by the Secretary of the Treasury to survey the much-disputed, mineral-laden Iowa, Wisconsin, Illinois triangle. On his boat journey from St. Louis, Missouri, to Galena, Illinois, in 1838, he enlisted some ninety men and trained them in the rudiments of the survey. During the three months of that fall he and his assistants surveyed and platted in detail some 11,000 square miles of woodland. In the spring of 1840, Owen prepared from his field plats an inch-to-the-mile map of the region. Here is a small portion of one of these now much fragmented, mildewed sheets recently found in the attic of the Senate Office Building in Washington.

(50) The formidable Rocky Mountain

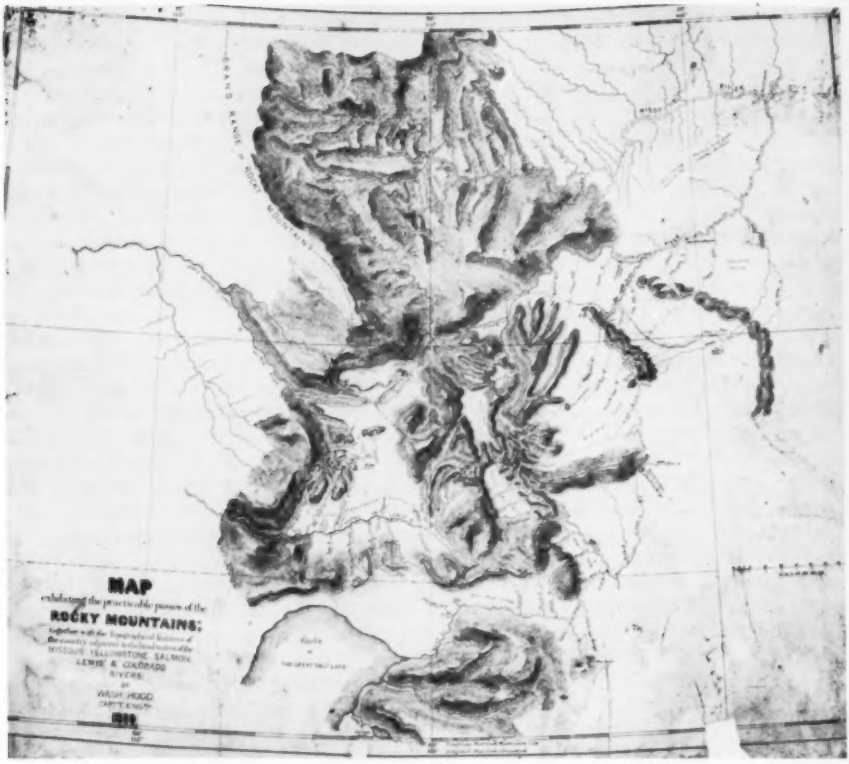

FIGURE 6.—(50) "Map exhibiting the practicable passes of the Rocky Mountains; . . . by Wash[ington] Hood, Capt. T. Engrs, 1839." Scale one inch to forty miles. (Dimensions 17½ × 23¼ inches.) Manuscript map on paper. Records of the Office of the Chief of Engineers (RG 77), Map US110, in the National Archives.

barrier was probed by topographers, fur traders, and military expeditions for the natural breaks or gaps. Discovery of South Pass that leads across the Laramie Plain and opens into the Salt Lake and Snake River country served as a gateway to most of the emigrants going west. In 1839 Captain Washington Hood compiled from field surveys this beautifully delineated map of that general region. Hood had mastered the use of the hachure. He was a leading topographer of this period.

(51) The extensive Great Plains region of grass and buffalo spreading eastward from the base of the Rocky Mountains must be surveyed and mapped in order that the Army should comprehend the best strategy and logistics to apply against the Indians in protecting the increasing number of emigrants moving west. In the 1840's the Topographical Bureau carried out much reconnaissance mapping of this large region, especially of the river courses and the best routes for travel. One such survey is shown on this map drawn for Colonel John Garland in 1843.

(52) In 1841 the round-the-world United States Exploring Expedition, under the command of Lieutenant Charles Wilkes of the Navy, charted the mouth and lower portions of the Columbia River in Oregon.

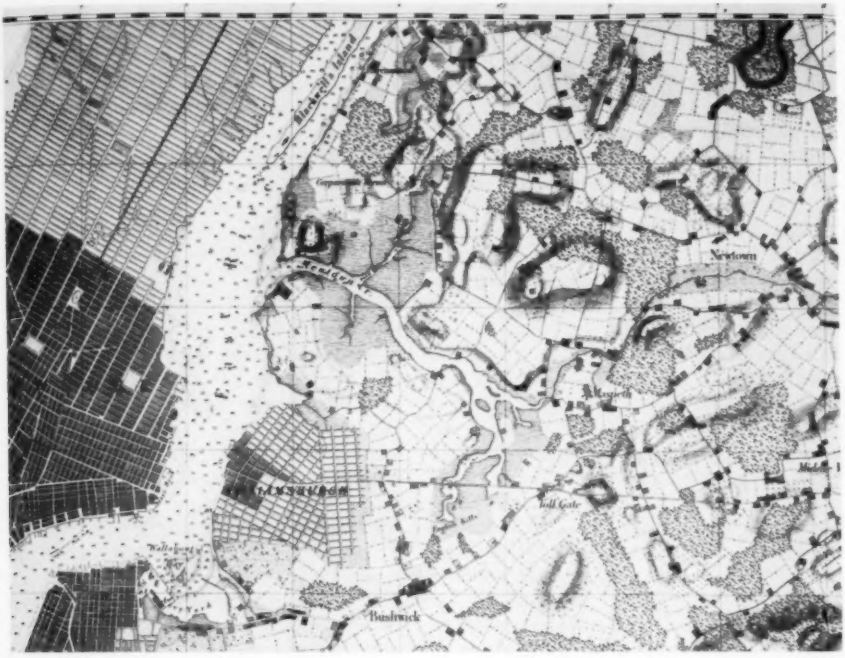

FIGURE 7.—(56) Part of sheet number 6 of a "Map of New-York Bay and Harbor and Environs . . . Survey of the Coast of the United States . . . Published in 1844 . . .," Very large scale. (Dimensions of Sheet number 6., 27 × 36 inches.) Published (printed) map on paper. Records of the Coast and Geodetic Survey (RG 23) Nautical Chart Series, in the National Archives.

Here is a portion of his chart of the entrance to the river. The topography of the north shore is shown by hachures with superimposed symbols for vegetation. This is one of the first charts published by the U. S. Navy.

(53) Lieutenant John C. Fremont contributed perhaps more than any other explorer of the 1840's to the accurate description and mapping of the broad physical features of the West. During the period 1842–1846 he was leader of five different expeditions. These were especially valuable because they came on the eve of the Great Migrations of thousands into the Far West. One of his major contributions was a "Topographical Map of the Road From Missouri to Oregon . . ." published in 1846 in seven sheets on a scale of 10 miles to an inch. Here is sheet four. You can imagine the value of such a set of maps to an emigrant train. (54) Another product of the second expedition in 1843–1844 was a topographic map of the route of survey from Missouri to the west coast. The west half of the map we see here shows part of the transection that Fremont made to tie his surveys into those of Wilkes at the mouth of the Columbia. Thus for the first time the country had been transected by a succession of observations.

(55) On his 1845–1846 expedition Fremont ordered Lieutenants Albert and Peck to survey the riverways, especially the Canadian River, leading to the southern Rocky Mountains, and from their notes this map was compiled. You will observe here the great emphasis that was placed on the careful plotting of the water courses and the adjacent terrain.

(56) The Coast Survey, which was reactivated under Ferdinand Hassler in 1832, during the next decade spent most of its time and efforts in surveying and charting the Middle and North Atlantic shoreline. Its standards were high and its personnel carefully trained, but prior to about 1844 very few charts had been published. Shortly after Bache became head, the Coast Survey published a succession of charts of exquisite composition and high quality. Here is a portion of a chart of New York Harbor from surveys in 1844. Most of these charts were struck from copper engravings so that clear sharp impressions could be made.

(57) Surveys and resurveys of the international boundaries of the United States have been required since 1783. One of the parties, under command of Andrew Talcott, U. S. Boundary Commissioner in 1841 for surveying the northeastern boundary with Canada, was caught in typical pose through a camera lucida. An artist made this watercolor sketch for us as a record of a survey team in action.

(58) The War with Mexico in 1847–1848, required topographical engineers to survey the terrain—and they were ready. Many maps were made, and officers and men acquired considerable training in field mapping. A good example of a map prepared during one of these campaigns is this portion of a map "of the City of Puebla [Mexico] and the Principal Roads Leading from it . . ." drawn by Lieutenant E. L. F. Hardcastle, a topographical engineer, in 1847.

(59) One hundred and nine years ago James W. Marshall "observed some glittering particles" at the edge of a deposit of mud he had just sluiced through the race of a saw mill he and Captain John A. Sutter had built on the South Branch of the American River in California. These few shiny particles became as magnets that drew to this El Dorado one of the great migrations of people in recent history. It may be fairly said that this discovery was responsible for "opening the West," certainly the region beyond the Rocky Mountain bastion. Few of us may know that one of the first, perhaps the first, official accounts of the discovery and description of this setting was by Colonel R. B. Mason, who, in the spring of 1848, was ordered to inspect the gold region above Sacramento. Here is one of the official maps prepared in the field to accompany his report and to show where gold was discovered.

V

THE WEST IS EXPLORED AND MAPPED FOR ROUTES TO THE WESTERN SEA: 1849–1861

(60) Discovery of gold in California, settlement of far forward areas such as those of Salt Lake City and San Francisco, and the unprecedented rush of large numbers of settlers across the plains and through the mountains to the Pacific coast, prodded the Federal government into an accelerated program of surveying and mapping and to examine the possibility of extending wagon and military roads and railroads from the Mississippi River to the Pacific Ocean. This was a period of widespread expansion of transport facilities in and through the West, in response to the phenomenal territorial growth of the country during the years 1846 through 1848, when Texas, California, and the Oregon Country, a total of more than 1,200,000 square miles, were added.

Aware of the needs for an accelerated program of mapping, the Topographical Bureau in 1850 compiled and published a remarkable map of the Western United States, of which this is a portion, on a scale of 1:3,000,000. This map was compiled from the best, carefully appraised sources on hand in the Bureau and was intended to show only such physical features as were provable by records. The primary physical features are shown by hachure and tint. We observe that much of this map is blank, that is, these are areas for which there was no acceptable information.

(61) In 1853 Congress authorized the War Department to undertake ". . . Explorations and Surveys for a Railroad Route from the Mississippi River to the Pacific Ocean . . ." Survey field parties of topographers, artists, and scientists of natural history, specially selected for their work, were assembled and placed under the leadership

of competent engineer officers. On this map are shown the four east-west routes of survey and the north-south route on the Pacific coast. (62) Though the primary objective was to discover and map the best route, the scientific byproducts of this large undertaking, which extended through 1857, were beyond expectation. Since one of the major byproducts was a wealth of new large-scale topographic information, many maps of the line of surveys were compiled, such as this manuscript "Map of the Survey of the Passes in the Sierra Nevada" of California in 1853. (63) Artists accompanying the expeditions sketched landscapes for use by the draftsman in a more accurate rendering of terrain. This is well illustrated by one artist's colorful sketch of the landscape of the floodplain of the Cheyenne River, the flat-top features of the surrounding plains, and the dissected walls of the river valley. Our attention is, of course, directed to the camp of the survey party.

(64) In addition to these specific surveys, there were many others of smaller extent and for shorter duration whose primary objective was to obtain topographic information for use in filling in the map of the new West. Here is such a map of the basin-range province of the desert area between California and Utah. The routes of survey can be spotted by the areas for which terrain information is shown.

(65) In 1857 the War Department published a "Map of the Territory of the United States from the Mississippi to the Pacific Ocean . . ." on a scale of 1:3,000,000. This monumental contribution, the first reasonably accurate map of the West, was compiled under the direction of Lieutenant Gouveneur K. Warren, who also prepared a detailed descriptive analysis, which includes a critique of the making of the map. In this analysis he says, ". . . comparatively few points in this large area have their latitudes and longitudes determined with precision, and the surveys and explorations vary in accuracy, by almost insensible degrees. . . .

"In some large sections we possess no information, except from uncertain sources. In these parts the rule was adopted to leave blank, or to faintly indicate such information as is probably correct."

Warren's rigid standards resulted in a map that became a kind of datum for reckoning the accuracy of subsequent intermediate and small-scale mapping of the West.

(66) Lieutenant Warren was one of the leading topographical engineers of the 1850's and 1860's. Shortly after completing the map we have just seen, he participated in numerous field surveys in the Great Plains and directed the compilation of the maps. Perhaps without knowledge of the perpetuity of his records and in a moment of reflective relaxation from his day's surveys on the High Plains of Nebraska, he sketched for us in his field notebook this memorable scene of yet another activity in the life of the engineer-topographer—bug-catching.

(67) During this period the surveying activities of the General Land Office were widespread and included the newly acquired lands of California. Considerable complications arose because of the inadequate and often vague descriptions and plats of the Mexican grants. There was a pressing need for resurveys and also clarification of the description and title to the land.

An excellent example of such a resurvey by Land Office engineers is this authenticated final plat of survey of the lands granted by the Mexican government to Captain John A. Sutter of Gold Rush fame. Few of us may have realized the considerable task these numerous conflicting land claims gave the General Land Office and the success it achieved.

(68) Attendant upon the acquisition of new lands by the Federal government and especially as a result of the Mexican War, there was need of a precise survey of the boundaries as spelled out in the treaty. Among the records of State Department in the National Archives are many authenticated so-called boundary and treaty maps. Here is one of sheets of compilation of the topographic map of the western portion of the United States-Mexican boundary surveyed under the Joint Commission in 1853.

(69) In 1859 there was published a series of maps of the areas in southwestern United States based on surveys. Here is a portion of one of these sheets covering the Colorado Plateau and showing especially the Grand Canyon. This was drawn by the topographer-draftsman, Ferdinand Egloffstein, in the Office of Explorations, using a new technique which, according to a note on the map, he ". . . conceived . . . while sketching the naked mountains, barren plains, and immense gorges in the region explored—of endeavoring to give the map the appearance of a small plaster model of the country, with the light falling upon it from a particular angle . . . The different tints are produced by means of five parallel lines drawn upon this copper engraving with a ruling machine . . ."

(70) During the 1850's and 1860's the Government conducted extensive surveys for military and wagon roads in the West. One of the more famous was the Mullan Road from Wallah Wallah, Washington, across the Bitterroot Mountains of Idaho to the military posts and mining camps in the northern Rocky Mountains. The cartographic results of these surveys of the late 1850's under Lieutenant John Mullan of the U. S. Army are among the best, and in a sense they rival those of the surveys for the Burma Road to China during World War II. This large-scale manuscript map shows the use of the contour in indicating relief.

(71) Landscape artists often accompanied a topographic survey team. The products of the quick pencil and analytical eye were of considerable help to the draftsman compiling a map, as, indeed, they are excellent records of the face of the land. This is Gustav Sohons' pencil sketch of "the Gates of the Columbia River as seen from Wallah Wallah," Washington, in 1859.

(72) Few of us will deny that this landscape sketch of the "Crossing of the Carson River" in Utah Territory in 1859, by an artist accompanying Captain John L. Simpson in his extensive surveys in Utah Territory, is a notable contribution to the graphic record of mapping of the West. Here apparently is part of Simpson's survey field party crossing the Carson River to its semipermanent base camp. Simpson's maps of Utah Territory in 1859 included much new information about drainage and relief that corrected misconceptions shown on maps of the day.

VI

THE CIVIL WAR: A RENAISSANCE IN MAPPING AND CARTOGRAPHIC PRESENTATION: 1861–1867

(73) The war between the States broke upon a nation almost totally unprepared militarily and cartographically. However, during the relatively short period of conflict, 1861–1865, considerable progress was made by both the Confederate and the Union Forces in the development of campaign strategy and of cartographic skills.

The first battle of Bull Run in Virginia on July 20 and 21, 1861, during which the Confederate troops under Generals Pierre T. C. Beauregard and Joseph E. Johnston outwitted and outfought the Union Forces, indicated to both sides the seriousness of the nearly total lack of topographic information. There was a tendency to prolong this lack, each side feeling that trusted guides acquainted with the field of battle were better than maps in the hands of personnel who might be captured. Failing at Bull Run, McClellan trained his army through to the next year and in March began his campaign against Richmond by way of the Williamsburg peninsula. His Chief Topographical Engineer was Colonel Thomas Jefferson Cram, an officer with considerable mapping experience. Cram prepared this map of the peninsula for McClellan and on the basis of this information the campaign was planned.

But Cram erred, and seriously so, for he incorrectly plotted the course of the Warwick River which, when the Union Forces entered the area, restricted their mobility and made it possible for Lee, who had built dams in the river, to open the flood gates and thereby contribute to the failure of the Union Army's Peninsular Campaign. (74) On this map, prepared at a later date by the top engineer officer General A. A. Humphreys of the Union Army, are shown Lee's

intrenchments along the corrected Warwick River. The general lack of good large-scale topographic maps for military operations was felt less by the Union Forces than by the Confederate Forces because the Topographical Bureau of the U. S. Army and the large holdings of maps were in Washington. However, the Confederate Forces held most of the land, especially in Virginia, for which the Army of the North had poor maps.

(75) When the war was in its early moments and Lee was preparing for a defense of Richmond, he had a copy of the only satisfactory map of Virginia, the "Map of the State of Virginia by Herman Boye 1825, corrected to 1859." Lee promptly commissioned Albert H. Campbell and placed him in charge of a topographical bureau in Richmond which became the central mapping agency of the Confederacy. Valiant were his efforts and significant were his results, but his office was constantly beset with a host of difficulties, such as lack of trained personnel and an acute shortage of paper, linen tracing cloth, inks, pens, instruments, and chemicals. Despite these seemingly unsurmountable odds, Campbell, by the end of 1862, had revised the old map of Virginia; organized and sent out thirteen survey parties; trained topographers for service with the field units; received, interpreted, and reproduced terrain intelligence; compiled, lithographed, and distributed maps, especially a series of the counties of Virginia on a large scale; and introduced and used photoreproduction mediums for the rapid production of maps for field use. On the night of April 2, 1865, the cartographic records of Campbell's office were placed aboard a North Carolina-bound train to avoid capture by Union Forces moving on Richmond. The mystery of the whereabouts of these records was not clarified by Campbell's subsequent witty remark that they probably were "burned to assure their safety." This "Plan of Belmont, Missouri, prepared from surveys of January 2, 1862," is an example of a Confederate-made field map. It appears that an unsuccessful attempt was made to burn it before it was captured by the Union troops.

(76) There were other well-qualified topographical engineers in the Confederate Army, for example, W. W. Blackford, under Jeb Stuart, and Major Jedediah Hotchkiss, under Jackson. The latter was perhaps the leading Confederate topographer and this is an example of the excellence of his work done for the Federal government in February 1866. What the Southern officers may have lacked in maps they acquired as terrain description by aggressive reconnaissance.

(77) The Union Forces were in a much more favorable position to develop a surveying and mapping program because they held the seat of Federal government with its mapping agencies and resources. Significant among these agencies was the Coast Survey and its large civilian scientific mapping staff which, under its dynamic Director, Alexander Bache, began an extensive mapping program to cover rivers and harbors and the Atlantic and Gulf coasts. Special emphasis was given to surveys of the Mississippi River and its delta areas. Utilizing their extensive archives and field surveys, they prepared for the military agencies a surprisingly large and valuable series of maps and charts, as well as supplying talented scientists to aid in specialized terrain analysis. Here is an example of the work they accomplished in the vicinity of Chattanooga. The Coast Survey's cartographic activities during the war are an example of optimum use of civilian scientists in military pursuits.

(78) Early in the war Dr. Thaddeus S. C. Lowe obtained approval of the Union Army to demonstrate his balloon as a medium for obtaining intelligence by aeronautical means. In this slide we see a reproduction of a sketch of Quantico and vicinity, Virginia, as made from a balloon over Charles County, Maryland. By 1862 Lowe had seven aeronauts in the field, and a balloon corps, forerunner of our U. S. Air Force, was under way. However, by 1863 this corps was disbanded because Union commanders were slow to realize the advantages of this predecessor of the aerial camera for obtaining terrain information.

(79) There were certain technological

developments in the field of mapping by the Union Forces that should be mentioned. These included the introduction of the photographic camera and sensitized paper for making quickly in the field at relatively small expense multiple copies of maps for use especially by troops in reconnaissance and intelligence mapping. This simple photographic copy of a map of an area in Paulding County, Georgia, is annotated in red pencil with information, presumably on the basis of field reconnaissance, showing roads, paths, and such changes in topography as the observer determined were necessary. These small pocket-size maps when returned from the field were assembled and matched in a specially designed mobile field wagon behind the front lines. In the wagon were facilities for the drafting, photoreproduction, and lithographing on small presses of composite maps for immediate battle use.

(80) Cloth, tissue, paper, and other mediums were utilized as a base for printing the maps. Contour and form lines gained in acceptance and use during the war, though hachures remained the standard. This portion of a map of the Environs of Washington, D. C., illustrates the use of hachures as a base, the photocopy being colored to give it a kind of third dimension.

(81) During the war the Topographical Bureau compiled, probably from Boschke's map of the District of Columbia, the plates of which had been confiscated by Union troops, a very accurate large-scale detailed twelve-sheet map of Washington and Environs showing relief by contours and fortified sites and elements of culture. Sheet four of this set is an example of one of the high points in mapping during the war.

(82) In 1864 and 1865, when General Grant was pressing his campaign against Richmond, topographical engineers with the Army of the Potomac undertook extensive systematic large-scale mapping of much of tidewater and piedmont Virginia. Here is a small portion of one of the large sheets on a scale of four inches to the mile. It has been selected because it is illustrative of the excellence achieved by the draftsmen in delineating terrain and cultural features.

(83) The wealth of cartographic, descriptive, and pictorial information that was accumulated, appraised, and arranged in the Headquarters of the Office of the Chief of Engineers in Washington during and shortly after the War, made it possible for that agency to publish a succession of surprisingly accurate intermediate and small-scale maps of the United States. On this slide is shown the northwest portion of the map published in 1867. By the end of this period the broad, general physical features of the country had been accurately mapped and delineated. The challenge now was large-scale detailed mapping of the West for settlement and transport facilities.

VII

SURVEYING AND MAPPING COME OF AGE: 1867–1879

In the post Civil War period the attention of many Americans, and especially of the Federal government, was turned to the extensive public domain of the trans-Mississippi and Far West. Here in this large subcontinent, nearly all of which was under the control of the Federal government, was a vast national resource, land. Land for the agriculturist, the settler, the livestock rancher, the prospector for minerals, and for commercial enterprises interested in developing the natural resources. During the postwar period this extensive area underwent a transformation "from the preserve of soldiers and mountain men to a potential source of wealth to many groups of citizens," and was open to our system of free enterprise.

(84) The scientific surveys of the 1850's to map the most practicable route for a railroad and wagon roads from the Mississippi River to the Pacific Ocean, found tangible results in the successful completion of the transcontinental Central Pacific Railroad and the driving of the golden spike at Promontory Point in Utah in 1869. In 1870, a group of Bostonians completed a railroad transit of the continent from Boston to the Pacific Coast in eight days.

The Coast Survey, renamed the Coast and Geodetic Survey in 1878, was made responsible for topographic and hydrographic

surveys of the coastal fringe of the country and for establishing a precise geodetic network throughout the land. In the 1870's this highly scientific agency, so long in *ad hoc* status, completed a remarkable triangulation of a transcontinental arc latitudinally along the thirty-ninth parallel to connect the Atlantic and Pacific Coasts.

But before this nearly two-thirds of the country could be settled and its natural resources tapped, it must be surveyed and mapped. The General Land Office accomplished a Herculean task in establishing the principal meridians and base lines into which to lace the metes and bounds of the rectangular grid pattern for initial settlement. The problem of detailed topographic mapping for an understanding use of the natural resources was not one of the authorized duties of this Office, yet it must be done.

(85) The Federal government, the States, and private organizations and individuals, engaged in the surveying and mapping of rivers and harbors for navigation, of lands for sale and resale, of natural resources for their most optimum use, of rights-of-way for railroads, roads, and traces, and for a host of other purposes. Time restricts our discussion here to a description of one of the most significant and also controversial series of surveys in the history of mapping in the United States. These are generally referred to jointly as the King, Wheeler, Hayden, and Powell surveys of the Western Territories. The Wheeler and King surveys were under the auspices and authorization of the War Department, whereas the Hayden and Powell surveys were under the Interior Department. The coverage and overlapping of these surveys for the period 1867–1878 are shown on this index map.

(86) In 1869, Lieutenant George H. Wheeler began a series of topographic reconnaissances in Nevada and Utah. By 1872 he was authorized by Congress through the Secretary of War to make "military and geographical surveys west of the hundredth meridian." On this index map are shown the sheets and the area he planned to cover. His primary objective was rapid large-scale topographic mapping of sufficient accuracy for military use.

(87) He employed small military-civilian parties of topographers, geologists, and guides. Here is a photograph of several members of such a party. Survey parties such as this one covered some of the most difficult, until then rarely seen, terrain.
(88) Manuscript map compilations of 1 inch to 2 miles were prepared. An example is this portion of a sheet covering the Rocky Mountain front in eastern New Mexico. It is interesting to note that the contour was used on most compilations but that hachures, stipple marks, and similar more elementary symbols were used on the final composite manuscripts.

(89) Here is an excellent example of one of Wheeler's final composite manuscripts of a portion of southern Colorado and northern New Mexico compiled in 1877 from the results of at least three years' field work, and prepared for a second edition in 1881.
(90) On many of his sheets Wheeler overprinted in color such special information as geology and economic features, as for example is shown on this sheet of part of his map of central New Mexico.

(91) The first principal effort of the Army to undertake systematic large-scale topographic mapping in the west was directed by a civilian, Clarence King. King, a scientist of high quality and good sense, in 1867 was given charge of a survey "to examine and describe the geological structure, geographical condition, and natural resources of a belt of country extending from the one hundred and twentieth meridian eastward to the one hundredth and fifth meridian of longitude, along the fortieth parallel of latitude . . ." This was essentially the line of the just completed Central Pacific Railroad. One of the objectives was to determine the geology and mineral resources in areas adjoining the railroad. During the period 1867–1874 a total of some 86,000 square miles of terrain was surveyed and mapped by King on a scale of one inch to four miles. Contours, with interval of 250 feet, were used to show slope, though King did produce some beautiful shaded relief

maps, as is shown on this portion of Map 1 of his *Geological and Topographical Atlas Accompanying the Report of the Geological Explorations of the Fortieth Parallel,* published in 1876.

(92) In 1887, Congress appropriated money for a survey to be conducted under the authority of the Commissioner of the General Land Office and directed by Ferdinand V. Hayden, a geologist of prodigious energy and many friendships. Hayden began his surveys in Nebraska and during the next decade extended his work into Montana, Wyoming, Idaho, Utah, Colorado, and New Mexico. Hayden's maps, of which the one on this slide is an example, were large-scale and show slope by contour.

(93) On this incomplete compilation of his sheet covering the Grand Canyon of the Colorado is an example of the use of both contour or form lines and hachures. You will observe that the draftsman employes hachures and shading for the steep-sloped scallops and walls of the canyon. Hayden's "Geological and Geographic Atlas of Colorado . . ." published in 1877, is an excellent example of comprehensive field survey, drafting, and color printing.

(94) To these widespread surveys was added yet a fourth, for in 1868 John Wesley Powell, a college teacher of natural history, wrote to President Grant that the Colorado River's deep canyon should be explored and its geological cross-section studied. The Colorado River and the adjacent inhospitable, deeply-dissected, desert plateau was the last completely blank area on the map. In 1869 Powell and his party were authorized by Congress to survey the area circumadjacent to the Grand River. The following year the Federal government financed what was probably the last "epic American exploration of completely unknown geography," the successful passage, the mapping, and geologic study of the Colorado River. One of the stations set up by the party is shown in this slide. This daring, carefully planned feat placed Powell on the national scene and established him as the head of a scientific survey of the province of his discovery. In Washington in 1870 Powell's persuasive way and administrative know-how quickly won for him the authorization of Congress to lead a "Geographical and Topographical Survey of the Colorado River of the West." His "Surveys" were extended in 1874 to the Rocky Mountain Region and his activities were placed under the Department of the Interior. (95) In the atlas accompanying his report on the geology of the eastern portion of the Uinta Mountains in 1873, is this colorful geological-topographical map which symbolizes the high point in surveying, mapping, and color printing of this period. In March 1878 Congress requested a review of these extensive projects for surveying and mapping in the West. It felt the time had come for consolidation and standardization of these activities.

In June the National Academy of Sciences was asked by Congress to review the Federal government's participation in the topographic and geological surveying of the United States. The Academy recommended a single civilian agency. The United States Geological Survey was created in 1879. This marks the transition into the modern era of surveying and mapping.

In this paper we have described but a few of the highlights in the history of surveying and mapping and of geographical exploration by the Federal government. As we try to comprehend the application of electronics, jet travel, computers, and space-searching rockets mounted with aerial cameras, to our science, it is perhaps wise that occasionally we should settle back and reflect on this past that is prologue, for this heritage that is ours is as rich in information as it is inspiring in accomplishment.

Federal Surveys: Coast and Geodetic, Geological, etc.

By ROBERT H. RANDALL

BUREAU OF THE BUDGET

MR. CHAIRMAN, ladies and gentlemen, I want to express my gratitude in at least two directions, first, to the College of William and Mary and to the Virginia Association of Surveyors, and, second, to Walter Dix for this very complimentary and very welcome introduction.

Mr. Dix and I, as he had not said, used to be associated in the business of making large-scale surveys and maps of metropolitan areas. One or two of the dates which Mr. Dix had mentioned I think will serve to date me pretty well, for example, my employment in the Geological Survey in 1913. I was interested to hear, I think from Mr. Friis, this morning, that George Washington was licensed at seventeen. Well, I can't claim that I was licensed at seventeen, but I do recall that I began working at surveying when I was about fifteen years old. I didn't make much money at this of course at this age, as a matter of fact never made much money since, but I think perhaps this is more or less typical of the surveying profession.

Speaking of surveying as a "profession," I think it was Kipling who said that, "When the waters drew back and the earth did appear, the Lord He created the engineer." It has often occurred to me that Kipling really must have had the surveyor in mind, because the first thing to be done, of course, is to survey the premises. But while whether this is called engineering or surveying is a matter of interest to a great many people, to me it is mostly semantic—mostly, a distinction without too much difference.

This morning you heard from Mr. Friis, and from others, about the early days of surveying and mapping in our country. In those days, surveying, and the maps which were compiled from surveys, were for the purpose of exploration, discovery, colonization, and settlement. Within recent times —I think of these as beginning with the organization of the Geological Survey, in 1879—the surveyor has been a servant to the cause of resource development as a part of economic improvement. When I say resource development, I mean natural resources. All of us, as surveyors, engineers, or economists understand that economic development has a double base: one in people, and the other in natural resources. These resources are the soils of the land's surface, the contents of the earth's crust, and the life that is in and on the water and the land. To identify, locate, and evaluate these means surveys and maps, which begin with geodesy and go on through topographic mapping, the principal base map or mother map and the basis upon which practically every other kind of resource map is made: geological surveys, soil surveys, surveys of natural vegetation, surveys of fish and wildlife, and hydrologic surveys and investigations. By hydrology, of course, I mean precipitation, stream runoff, ground water, and various aspects of meteorology. So that today while the surveyor continues to be concerned with the determination of property boundaries and the layout and design of all kinds of structures, he is also joined in a sort of larger fraternity with those who are interested in resource development and have to depend upon the surveyor's contribution for the basis of their work.

The title of my talk this afternoon is one which interested me and gratified me. I don't know exactly who fixed it up, but it says, "Federal Surveying and Mapping—Coast and Geodetic Survey, Geological Survey, etc." Now I think that in this "etc." there is quite an opportunity. It occurs to me that you could start with a title like that and really sound off in practically any direction. I am reminded of a trip I made some years ago when I was living in Ohio. I made a trip across northern Ohio by auto-

mobile, and on the outskirts of a rather small town I noticed that there was a huge signboard, set up by the local Chamber of Commerce, which said, "This is the center of the Universe—you can start here and go anywhere." Well, from the looks of the town, most everybody that had started there *had* gone some place else, because there weren't very many there. But I hope I can restrain my enthusiasm here this afternoon and not get too far away from my presumable topic. But this title of "etc." is really intriguing.

In the early days, the days which Herman Friis has described most competently, and which were touched upon in the opening addresses this morning, surveying was largely sporadic, and unorganized. There were temporary organizations, set up *ad hoc,* just for the immediate purposes. With the advent of the Geological Survey organization, which, you will recall, was recommended by the National Academy of Sciences in 1879, we began to get into this business of organized, systematic gathering of the information necessary for resource development and consequent economic improvement. Now, if you will let me refer to some notes, I should like to read off the natal dates, so to speak, and to comment briefly upon the organization of the various Federal surveying agencies, as they came into being through the years. This will necessarily overlap a bit Mr. Friis' paper, but I hope that you will bear with me.

Of course we have to start by saying that the Army Engineers were in the business of surveying and mapping since our earliest times. As soon as we had a Continental Army we had some kind of surveying and mapping, naturally applied mostly to military purposes. And all through the years the Army, through its Corps of Engineers, has been active and productive in mapping. At the moment the Army's mapping efforts are directed toward the compilation and publishing maps outside of the United States and its territories and possessions.

Always bearing in mind the fact that some kind of surveying and mapping activity has always been characteristic of the Army Engineers, we can list the first *systematic* Federal surveying activity as being the cadastral surveying work, first under the Surveyor General in 1798, and then organized in the Interior Department, as I recall it, in 1812, as the General Land Office. Very soon—and it will be very soon, because even with my title of "etc." I don't propose to talk too long—Donald Clement will tell you about the work of the General Land Office, but under its present name, the Bureau of Land Management, which it assumed in 1942.

The next on the list was the Coast and Geodetic Survey, organized in 1807, as my notes indicate and as I recall, twice abstracted from civil government affiliations and put into the Navy, and twice put back into the civil part of the Government.

The third in chronological order would be the Hydrographic Office of the Navy, organized in 1830 as the Department of Charts and Instruments, and in 1866 as the Hydrographic Office, under which name it still operates.

The fourth would be the Mississippi River Commission, which has done a certain amount of mapping, topographic and hydrographic, as well as quite a lot of hydrologic work connected with stream flow, runoff, etc.

Fifth, I should say would be the Lake Survey. This began under the Corps of Topographic Engineers of the Army and was organized as the Lake Survey as a separate—more or less separate—identity in 1832.

Number six on the chronological list brings us back to the Army Map Service, which was set up in pretty much the shape that it is now as part of the Corps of Engineers in 1863, and since 1942 has been designated by its present term, the Army Map Service.

The seventh would be the Weather Bureau, concerned with meteorology and hydrology. This was organized in 1870 in the Signal Corps of the Army, moved over into Agriculture in 1891, and into Commerce in 1940.

Number eight would be the Geological Survey, in 1879, and, as I said before, this really marks the point at which the basic topographic mapping of the country was placed on an area-coverage basis, rather than an expedition, or route-mapping, kind of basis.

Soils classification and survey began in 1894, first in Interior, and then in 1935 was transferred to the Department of Agriculture.

The Forest Service would be number ten in order of time. This also was originally in Interior, and began in 1905.

The Fish and Wildlife Service began in 1930, and was reorganized with its present status and situation in Interior in 1956.

The Tennessee Valley Authority in 1933, by Act of Congress, would be Number 12.

Number 13 is the increasing activity of aeronautical charts. The Army, when it was the Army Air Force and even before, did some compilation and publication of charts designed as an aid to air pilots. So in 1940 there was an Information Service in the Army called the Army Air Service. In 1942 the Army Air Force had a map and chart division. In 1944 the Aeronautical Chart Service was organized. In 1951 it was designated as the Aeronautical Chart and Information Center of the Air Force.

This doesn't quite complete the list. In the realm of physical resources there is also the Health, Education, and Welfare Department, which, while the Geological Survey is concerned with the surface and underground water and the chemical quality of water, the H.E.W. is concerned with the biological quality of water, and with pollution aspects. This department, with an eye to such things as the Los Angeles Area condition and the smog situation in our other communities, is running quite a program on behalf of air testing, toward maintaining the proper supply of fresh air for our metropolitan areas. Good air, of course, quite obviously, is going to be realized to be just as necessary as good water. I understand that already this Department has some 80 sampling stations in as many metropolitan areas, checking up on how much pollution there is from factories, from automobile exhausts, and from other sources.

It seems to me that probably I have said enough about basic physical resources, and surveys and investigations. In addition, I must mention the activities that are concerned with the assembling of information about people—human resources—their numbers, characteristics, distribution, means of employment, their institutions, and their means of livelihood. Such facts, though their gathering is outside of the surveyor's usual activities, are needed for economic development and improvement.

I hope it does not seem too much of a far cry, to us who talk about surveying and mapping, to think about surveying and mapping in terms of economic development. We have not abandoned the original purposes of surveying for routes, and location, and construction, but we have begun to realize that we are a part of the economic betterment program of our Country, and so must, to an appropriate degree, cooperate with the geologists, the soil scientists, and other specialists in the resource development field.

I think we have, perhaps, gotten into this kind of an attitude of a position partly because many new scientific aids to resource discovery and identification are also part of the modern procedures of surveying. Quite a few of here today are not only members of the American Congress on Surveying and Mapping, to which Chairman Dix has referred, but of the American Society of Photogrammetry, and the American Society of Civil Engineers. And all of these people, and I suspect practically everyone in the group here this afternoon, know about the contribution that air photography is now making to surveying. There are other contributions, of course. Electronics comes into the picture—the business of timing a beam of light, or an electrical impulse, in its transmission and receipt back to the original station. This is rapidly, in my estimation, going to replace a good part of our present procedure in triangulation. We are going to use trilateration to an increasing degree. The Federal agencies most concerned, primarily the Coast and Geodetic Survey, the Army Engineers, and the Geological Survey, are following this and other developments very closely.

I would like to take a moment here to say that several weeks ago we had a demonstration of an instrument called the "Tellurometer," this being simply and sweetly developed from *Teluria,* the old Latin name for the world, and *measurement.* This was in

the Washington area, and the gentlemen from South Africa (where the instrument was originated) making the demonstration set up over one triangulation station and pointed at another one, and measured the difference between by just timing the beam. Well, it came out within an inch or so, and this seems to me to be very nice going. But there was one thing (and I suspect that when I see the transcript of this, I am going to do a little editing)—one thing that tickled me at the time. You can all imagine that among the Federal surveying and mapping agencies there is a certain degree, and I think a very healthy degree, of competition. Now this, if you please, is competition in pursuit of excellence—nobody trying to run anybody down, but everybody trying to do things just a little bit better than anybody else. On this occasion we were having some movies taken of this demonstration, and, shading the instrument, was a great big beach umbrella. And on that there were the initials of a certain well-known Federal agency. I was enormously entertained to see that when those initials got toward the camera that was taking the picture, a gentleman from one of the other agencies went up and turned it around, so that those initials would not get into the picture!

We are in our Country profiting not only in the making of topographic maps and in the making of geodetic surveys by these new methods, the air photograph, the electronic devices, etc., but our friends in resource investigations, the geologists, for example, are also profiting by such things as the airborne magnetometer, and the airborne scintillometer, which, as you know, is a Geiger counter in an airplane. Our soil scientists are using air photography increasingly, and have been for years. Increasingly air photography is used with various kinds of filters and films to identify and classify soils. Our geological friends are also using photographs, put together in stereoscopic relation, to identify geological structures that are worth looking into, and thereby being able to plan better for their programs of ground surveys. Also, vegetation (different kinds of vegetation) is now pretty well understood to indicate certain minerals that are coming up through the surface geology, and air photography with appropriate films and filters is also being used in geological investigations.

In all of this the surveyor is marching along with his collaborators in the process of economic development. The services of the surveyor and the techniques of surveying are employed by soil mappers to make their surveys and produce their maps. The geologists have to make maps, or they have to have them made. It is obvious, and has been demonstrated in actual test, that if you want to make a soil map, to classify and map the boundaries between soils, you need a geologic map of the same area, for obviously soils are surface geology, acted upon by climate and vegetation.

It is also obvious that you ought to have a topographic map before you try to make a geological map. Otherwise the geologist must go out and make a map, a relief model of the terrain, before he can make his own studies. And again, going back further, it is obvious that in order to make topographic maps and tie them together you must have a framework of control, which is to say geodetic surveying. So all of these things are closely related, and we, the surveying profession, are now a part of the business of the discovery, identification, evaluation, and utilization of natural resources.

We are a part of this not only in the United States but all over the world. We are concerned, increasingly, as you may see in the papers, and as you can hear in Washington and all over the Government, because everybody in the world is day by day a closer and closer neighbor. It is equally obvious that we want these neighbors to be good neighbors. Therefore, we do not want them to be envious of us. We have so much in comparison to what many people have, and this great differential between the levels of living makes for disorganization, unrest, anarchy, and, ultimately, the organization of government affairs into some system which we would not like, and which will not permit them to be good neighbors. Helping the peoples of the earth to be good neighbors through offering them technical assistance and economic aid is a tremendous and challenging job. In it the surveyor has a big

part to play. I go along with Kipling, who said that he came first. Certainly he should.

One way in which the surveyor-engineer can take his part in national and international improvement is by joining organized professional groups, such as the American Congress on Surveying and Mapping and the Virginia Association of Surveyors, represented here today. Another way is by organizing on the regional and international level, and I'd like to take just a minute or two to tell you a little bit about such international organization.

In America the twenty-one republics have set up, in what is known as the Pan American Institute of Geography and History, a commission on surveying and mapping. It is called the Commission on Cartography, because *cartography,* in the Romance languages, translates pretty closely into surveying, mapping, and charting, etc. This Commission has since 1943 held some seven meetings in various parts of the American scene, and at those meetings the people who are at or near the top in scientific and administrative surveying posts all over the Americas, get acquainted, develop the habit of working together across national boundary lines, and agree upon specifications which are increasingly uniform. In my opinion, the time is rapidly coming when basic surveying activities such as geodesy, topographic mapping, aeronautical charts, etc.—all over the American Republics and Canada—will be just about as uniform in respect to specifications and methods as they are now in our own Country, from State to State. This, we can all agree, is enormously advantageous to them and to us.

I recall one example of this way this has worked out, this business of the American nations getting their surveyors together. This was when the United Nations set up the Provisional Civil Aviation Organization in 1944–45. At PICAO's first meeting in Chicago our friends the British (I learned more about the British yesterday afternoon and evening in Jamestown than I have known for quite a while, and I hope you all get a chance to see the Old World Exhibition down there) came with their own ideas as to the specifications of the principal series of world-wide aeronautical charts, to be on the scale of 1:1,000,000. They found that a year or so previous the Commission on Cartography of the Pan American Institute of Georgaphy and History had agreed upon specifications very close to those of the United States. The position was, therefore, that the United States, the other twenty republics, and the Dominion of Canada were all agreed. Our friends, the British, gracefully conceded the point, and agreed to the present specifications of the World Aeronautical Chart series. That is an example of how effective the surveyors and mappers of the American continent can be when organized on the regional level.

Some years ago, in 1949 to be exact, the United Nations assembled a committee of so-called experts in surveying and mapping —I say "so-called" because I was one of them—who made and published a report, as a consequence of which the United Nations set up what is a surveying and mapping office. It is called the Cartographic Office, because, again, "cartographic" is a world which pretty well encompasses all of the various kinds of surveying and goes nicely into translation. The United Nations have since then had one regional meeting, about two years ago, in India, and another regional meeting is scheduled for 1958, in Tokyo. These are pretty much patterned, as to organization and procedure, on our American meetings of the Pan American Institute of Geography and History.

I want to make one more observation, after which I think Mr. Chairman, I will thank you all for your attention and asked to be excused. The remark is this—that our surveyors, our mappers, our resource investigators, do not yet play a sufficiently prominent part in this business of economic development, in making our neighbors into good neighbors. So far, in my personal view, the business of economic development proceeds altogether too much like the business of making rabbit stew without rabbits. Our technical assistance programs, in the United States, in the Organization of the American States, and in the United Nations are, to adopt a crude figure, something like this: We invite people from various locali-

ties to come and dine with us. Then we serve them rabbit stew. This is a very tasty as well as nourishing dish, and they become fond of it. Then we tell them "OK, we will show them just exactly how to do it, what equipment is necessary, etc." And then we tell them "Goodbye," and they go back home. Then they are up against the job of catching rabbits. Now the fact is that we teach people, as a part of our various aid programs, how to develop their resources, *but they don't know what their resources are.* Literally and truly, America, and practically all the world, has been discovered. Further, it has been explored in a superficial way at least, practically every part of it. At the moment, we, aided by some other nations, are surveying and making scientific investigations on the last remaining large land mass, the continent of Antarctica. But the *resources* of the world, even in the United States, have not yet been really discovered. This of course requires an educated appreciation of what to look for, but it also requires something more than that. The old process of looking for water by means of a hazel switch, or divining for precious metals by similar procedure, was like looking for a needle in a haystack. It isn't good enough. We need systematic coverage, surveys of the soil, geology, timber, water supply, etc. From these we can tell where the best opportunities for resource utilization are. I couldn't help but think this morning, while Mr. Friis was telling us about those earlier surveys, the Fremont, the King, the Powell, etc., of what John Wesley Powell, for example, would have done if he had had the airplane and airborne cameras, magnetometers, etc., that we have now. He was obliged to traverse over restricted areas, to go in various directions over our part of the planet, and try to find out what he could. But how he would have relished the air photography, airborne magnetometry, scintillometry, electronic aids to distance measurement, etc., that are available to us now! A lot was done in the old days, and again, as Kipling has indicated, it has been going on for a long time. There have been surveyors for a long time, and they have made surveys and maps for all kinds of purposes, but it is certainly my hope, and I am sure that you will agree, that we as surveyors get increasingly into this business of bringing about an economic development which will improve the world to the point where not only we but our neighbors can be increasingly happy in it.

Washington State Bureau of Surveys and Maps

The following excerpts from Bulletin No. 2, (April 1958) of the Washington State Bureau of Surveys and Maps are a sort of "hop-skip-and-jump" review or scanning of a very interesting two-page, processed publication of this rather new, and apparently quite vigorous, surveying and mapping organization. —EDITOR

The Bureau has been integrated into the Department of Natural Resources created by the 1957 Legislature and is now under the direction of Bert L. Cole, Commissioner of Public Lands. The Bureau serves as a coordinating center and central library for both public and private surveying and mapping for all areas of the State. The first issue of this bulletin was mailed to 1,380 addresses one year ago. Sharp budget cuts delayed No. 2 until now.

WANTED: Specific facts, history, anecdotes, or personal recollections of uncertainties and anomalies in your county boundaries. The Bureau is compiling these data into a central record in response to inquiries by cartographic agencies.

A recent list of 160 U. S. and foreign abstracting and indexing services (*American Documentation,* January 1957, pages 8–21) produced not one service specializing in or even including surveying and mapping. We receive 32 U. S. and foreign periodicals concerned with surveying and mapping, and more will be added this year, including some Russian ones. Reviews of articles will appear in coming issues of this bulletin.

Recent Bureau Reports: "A Bibliography of U. S. and Foreign Periodicals concerned with Surveying and Mapping," "Washington's Extended Use of State Plane Coordinates," "A resume of the meeting (September 16) of the

(Continued on page 224.)

Public Land Surveys—History and Accomplishments

By DONALD B. CLEMENT

CADASTRAL ENGINEERING OFFICER, BUREAU OF LAND MANAGEMENT

MR. CHAIRMAN and fellow guests: May I express my appreciation of this opportunity to be here at this Surveyors' Day in historic Williamsburg. Surveying is an ancient and honorable profession and it is only fitting that representatives of that profession should meet to review what has gone before. I bring to all of you greetings from the Bureau of Land Management, the unit to which I am attached, which is the oldest organized surveying activity in the Federal Government.

My work deals entirely with the survey of the public lands and I would like to discuss with you briefly the history and accomplishments in that field of activity in the United States.

It is safe to say that relatively few people realize and appreciate the importance of the rectangular system of public land surveys in the settlement and development of the vast public domain. Even less is known of the basic contribution it has made to our political and economic advancement. Like many of the advantages we enjoy, it has been accepted as an obvious thing, whose benefits, if considered at all, now appear so self-evident that seemingly no other course could have been followed. But when this survey scheme was established by the Continental Congress in the Land Ordinance of May 20, 1785, no counterpart or pattern for it existed. The plan, as developed, was unique in three respects: First, it introduced the new principle of "survey before settlement;" second, it introduced the concept of a mathematically designed and nationally integrated cadastral survey; and third, it created a standard land unit, the section, of uniform shape and area and with boundaries physically marked on the ground.

It might be well to consider why this scheme was developed and where it was applied.

With the founding of the Republic, the Colonies ceded their western lands to the central government in order that funds might be realized for payment of the cost of the Revolutionary War and to provide lands to reward the soldiers of that war. This nucleus of the public domain embraced the very large area north of the Ohio River, extending from the west boundary of Pennsylvania to the Mississippi River and the lands from the west boundary of Georgia to that river. It was for the management of this area that the scheme of the rectangular system of public land surveys was conceived.

During the first seventy-five years of our national existence there were added to the public domain, areas in the Louisiana Purchase in 1803, the Florida Cession in 1819, the Annexation of Texas in 1845, the Oregon Territory in 1846, the Mexican Cession in 1848, and the Gadsden Purchase in 1853. At its greatest extent, the public domain embraced 1,441,346,560 acres, or more than 2,255,000 square miles, representing approximately 75 percent of the area of continental United States. This domain included the States of Florida, Alabama, Mississippi, and all States north and west of the Ohio and Mississippi Rivers except Texas. The acquisition of Alaska in 1867 added 365,481,000 acres to the public domain. It is this tremendous area, totalling more than 1 billion 800 million acres, which constitutes the field of application of the rectangular system of public land surveys.

As to the factors which prompted the development of an orderly scheme for the survey and disposal of the public domain, it may be pointed out that the American colonists coming from the Old World countries, were imbued with the concept of America as a New World. Here land was plentiful and easily obtainable. They were

not inclined to forget the oppressive land tenure practices of the Old World feudal systems. From the earliest days there was an indicated intention for security of freehold titles in the individual. The dissatisfaction with the old order of indiscriminate and random division of lands was also manifest early in Colonial times. One writer says of this phenomenon of attempting regularity of land partition in a world where such orderliness was unknown, "So early were the common lands thus laid out by men who had, up to that time, been familiar with the irregular method, that it seems as if the plan must have been one of the first products of the new American environment. Under the stimulus of unlimited area and an untouched soil, the newcomers at once improved the old system of dividing land."

The New England "Town Commons" were generally arranged in regular form and subsequent "pitches" or land claims in these organized areas tended to conform to the regular plan of the original layout. In the outlying areas also, an effort was made toward regular and uniform shapes of land disposals. As an example there may be cited a Maryland warrant of March 7, 1641, which directed the surveyor to ". . . lay out four thousand acres of land . . . and bound it with the most natural bounds as near you may to the form of a parallelogram."

The trend toward regularity and uniformity in land disposals was incorporated into the laws of some of the Colonies, in the purchase regulations of the large Proprietors such as William Penn, Lord Baltimore, and the Earl of Shaftesbury of the Carolinas, and in the warrants for surveys of most Colonies. The early warrants of Penn instructed the surveyor to lay out lands "according to methods of townships appointed by the Proprietors." Lord Baltimore directed the lands to be laid out in regular order.

Unfortunately these reasonable requirements were almost completely disregarded except in New England. There the grants tended to become more square and of uniform size. Although directives existed in nearly all of the Colonies for the systematic layout of lands, the results were negligible except in New England. It seems that, while the virtues of land boundary regularity were recognized by our forefathers, they chose to exercise the most novel of their new freedoms—the right to pick and choose for themselves.

As attractive as this freedom of choice—free from all regulatory restraints—might appear to the settler, in time it created a situation of confusion, conflict, and controversy as to land boundaries and ownership.

In 1699 the House of Assembly of Maryland passed "an act ascertaining the bounds of land." This was an early attempt to rectify the problem caused by unsatisfactory settlement practices. Boundary locations were a problem, but the greatest concern was the excess of land in the grants over the quantity called for in the warrants. Apparently there was seldom a deficiency. The surveyor was blamed for this and possibly rightly so, but you can readily visualize a claimant (who was also the employer) pointing out to the surveyor the bounds of the land he wanted surveyed. The surveyor had little alternative but to survey the lands in accordance with the selection of his employer.

An indication of the confusion which existed at that time may be gained from this act of the Maryland Assembly of 1699, which states in part, "Whereas, at the first taking up of lands in this Province, necessity constrained His Lordship to commissionate such persons to be surveyors as was but very meanly skillful in the art of surveying; . . . and the said bounds are generally expressed in such uncertain terms, and being many times contradictions and inconsistent in themselves, whereby it comes to pass that at this time is very uncertain and many chargeable and tedious suits in law happen about such bounds, which are most times (as it were) by the favour and inclination of jurors arbitrarily determined differings ways in parallel cases." In 1715 a five-man commission was set up to hear and determine all differences and controversies in the matter of land boundaries. They had broad powers of subpoena and

could hire surveyors who in cases of minor retracements "shall have only a quarter of a pound of tobacco per perch and no more."

Even earlier, in 1661–1662, the General Assembly of Virginia in connection with a bill providing for "processioning" said, "many contentious suits are dayly incited and stirred up about bounds of land for which noe remedy hath yet bin provided." By 1705 they were forced to come to grips with the problem and passed "an act concerning the granting, seating, and planting and for settling the titles and bounds of lands."

This gives an indication of conditions which created a basic demand for the development of an orderly plan for survey and settlement of the public lands in the Western Territory.

In 1784 a Commission of the Continental Congress, of which Thomas Jefferson was chairman, reported an ordinance for the mode of locating and disposing of the lands in the Western Territory. This was considered and discussed at length. As amended and adopted by the Congress on May 20, 1785, it become the foundation on which was built the structure of the survey of the public lands.

This land ordinance provided for the survey of the Territory into townships, six miles square, by lines running due north and south and others crossing these at right angles. The ordinance further specified that "the lines shall be measured with a chain; shall be plainly marked by chaps on trees and exactly described on a plat; whereon shall be noted by the surveyor, at their proper distances, all mines, salt springs, salt licks, and mill seats that shall come to his knowledge; and all water courses, mountains and other remarkable and permanent things over and near which such lines shall pass; and also the quality of the lands." The ordinance also provided that "the plats of the townships, respectively, shall be marked by subdivisions into lots of one mile square, or 640 acres, in the same direction as the external lines, and numbered from 1 to 36." The surveys were directed to be made by a corps of surveyors, one from each State, to operate under the direction of the Geographer of the United States, a position held by Thomas Hutchins. The Geographer was directed to "personally attend to the running of the first east and west line and shall take the latitudes of the extremes of the first north and south lines and of the principal rivers."

The surveys under this act were known as "the seven ranges" in Ohio. The first township surveyed under this ordinance is in what is now Jefferson County in the vicinity of Steubenville, Ohio; the survey was executed in 1786 by Absalom Martin of New Jersey.

Late in 1785, Thomas Hutchins submitted to the President of the Continental Congress "a plan and remarks of that part of the Western Territory through which an east and west line has been run." The east and west line which he ran extended only four miles westward from the intersection of the Pennsylvania boundary with the Ohio River but his notes covered eight closely written pages in describing the slopes, soil, trees, and even medicinal herbs along the way. This established a pattern for reporting the character of the land, soil, and timber which has been followed in the survey of the public lands from that time to the present, though probably the detail given in the Hutchins report has not since been equaled.

The administration of the public lands at that time was under the Treasury Department of the Federal Government. In 1790 Alexander Hamilton, Secretary of the Treasury, submitted a report to Congress on the administration of the public lands. He proposed the establishment of a General Land Office in the Treasury Department and that a Surveyor General be in charge of the public land surveys, with a corps of deputy surveyors to execute the surveys. His recommendations were not acted upon immediately and, after much delay, only in installments.

Some of these recommendations were incorporated in the act of May 18, 1796, which provided "that a Surveyor General shall be appointed whose duty it shall be to engage a sufficient number of skillful surveyors as his deputies whom he shall cause,

without delay, to survey and mark the unascertained outlines of the lands lying northwest of the River Ohio and above the mouth of the River Kentucky, in which the titles of the Indian tribes have been extinguished, and to divide the same in the manner hereinafter directed." This act went on to provide for the subdivision of the Territory into townships much the same as in the land ordinance of 1785. The act also required that "the corners of the townships shall be marked with progressive numbers from the beginning; each distance of a mile between said corners shall also be marked with marks different from those of the corners. Half of the said townships, taking them alternately, shall be subdivided into sections, containing as nearly as may be, 640 acres each, by running through the same each way parallel lines at the end of every two miles, and by marking a corner on each of said lines at the end of every mile." The act also provided that all of the lines were to be measured with chains containing two perches of 16½ feet each and for the marking of witness or bearing trees at each corner location.

This is the first reference to a section as the unit of subdivision of the township and is also the first statutory requirement for the physical establishment of corners on the boundaries of the townships and sections. Other early laws providing for the survey of the public lands were the acts of May 10, 1800; February 11, 1805; and April 25, 1812. However the land ordinance of 1785 and the act of 1796 are considered to have established the basic principles in our surveys of the public lands; on these two acts hang all the laws and the prophets so far as public land surveys are concerned.

The act of May 10, 1800, provided for the running of section lines at intervals of one mile and the establishment of quarter-section corners. The finality of the surveys was guaranteed by the act of February 11, 1805, which provided that:

1. All of the corners marked in the surveys returned by the Surveyor General shall be established as the proper corners of the sections or subdivisions of sections which they were intended to designate.

2. The boundaries actually run and marked in the surveys returned by the Surveyor General shall be established as the proper boundary lines of the sections or subdivisions for which they were intended, and the lengths of such lines as returned in the surveys shall be held as the true lengths thereof.

3. Each section or subdivision of section shall be held and considered to contain the exact quantity of land returned in the survey.

Rufus Putnam was the first Surveyor General under the act of 1796. He served from 1797 to 1803, followed by Jared Mansfield, Josiah Meigs, and Edward Tiffin. That part of the Northwest Territory which became the State of Ohio was the experimental ground for the development of the rectangular survey system. Here the plans and methods were tested in a practical way and notable revisions in the rules and practices, based on the earlier experiences, were made applicable as the surveys progressed westward until the plan became perfected. Much credit must be given to the work of the early Surveyors General in developing and perfecting the plan of surveys. During their incumbency in office, the surveys in Ohio were largely completed and the work had been extended into Indiana and southern Michigan.

The adoption of the rectangular system marked the transition from the surveying practice prevailing in the greater part of the colonial States where land grants were defined by irregular metes and bounds, each depending more or less on the description of an adjoining tract; which was known by name and number, and mostly without common geographic location other than a possible reference to some well-known natural object.

The general plan of the rectangular system of public land surveys is well known, particularly in the portions of the United States over which it has been extended. Its importance in our history is such that many high school textbooks describe its features

and advantages. No attempt will be made here to describe this system in detail. Suffice it to say that the basic unit of survey is the township, six miles square. The next lower unit is the section, one mile square. Since the townships are arranged in a checkerboard pattern, oriented north–south and east–west, which is a coordinate system of construction, each township can be described as so many townships north or south of the base line and so many ranges east or west of the governing principal meridian. The sections are laid out within the township in a systematic manner, beginning with No. 1 in the northeast section and proceeding west and east alternately with progressive numbers to No. 36 in the southeast section. Operational errors are prevented from accumulating and geodetic factors compensated for by the establishment of standard parallels (or correction lines) and guide meridians at stated intervals.

It must be realized that from its inception in 1785 until about the turn of the 20th century, the public land surveys were carried forward in virgin territory—unexplored and unmapped—in advance of settlement. The records of those surveys, consisting of the official plats and descriptive field notes, afforded substantially the only information as to the character of the land and its resources. The field notes, for example, contain the surveyor's estimate of the quality of the soil for each mile surveyed, remarks on the lay of the land and description of vegetation, as well as information on streams, lakes, and ponds. The plats show the lengths and directions of lines and the legal areas of sections and their subdivisions as well as planimetric data such as the streams and lakes and the extent of prairie or swamp land.

Looking back over the history of the westward expansion of this Nation, we must realize that the information afforded by these basic survey records was essential to that expansion and was relied upon by those who purchased the lands in the early days, those who sought agricultural lands under the Homestead Act of 1862, and those in search of timber and other resources of the land.

The rectangular system of public land surveys was extended before settlement. Thus, with every surge of their drive to the frontier, the settlers found that the Government surveyors had been there before them and had neatly blocked out the agricultural land into mile squares, with the boundaries definitely established and marked on the ground.

The history of the development of this country can be traced largely by the timing of the public land surveys. The annual reports of the Commissioner of the General Land Office were for many years accompanied by a map showing the extent of the public land surveys executed to the date of the report. It is fascinating to follow the progress of those surveys and to picture the development of the country which followed.

By the 1860's, the surveys had been extended across the Mississippi and embraced practically all of Louisiana, Arkansas, Missouri, Iowa, and southern Minnesota; you will also find that large areas in California and Oregon had been surveyed to accomodate the settlement following the gold rush of 1849 and the migration to the Oregon Territory. The map accompanying the report of 1865 shows surveys in eastern Kansas and Nebraska and along the old Santa Fe Trail in New Mexico in advance of settlement in that area, and in a very small portion of Colorado to accomodate the settlement after the discovery of gold and silver in the Cripple Creek area. That map also shows limited surveys in Utah to accomodate the influx of the Mormons. Vast areas comprising the Dakotas, Montana, Idaho, Wyoming, Nevada, much of Kansas, Nebraska, Colorado, Utah, New Mexico, and all of Oklahoma (then Indian Territory) and Arizona were entirely unsurveyed at that time.

Prior to 1910, the public land surveys were executed by a corps of deputy surveyors who operated under negotiated contracts at a price from about $2 to $8 a mile.

By act of Congress the contract system of surveys was abolished in 1910 and since that time the work has been carried on by a corps of cadastral surveyors on the Federal pay-

roll. The reason for the change from the contract system to the direct employment system was largely the fact that the remaining unsurveyed public lands were relatively scattered and in small blocks in difficult terrain. Difficulty was experienced in contracting for the work at the rates allowed by law. Coupled with this there was the necessity for resurveys occasioned by the disappearance of the corner monuments, due to lapse of time and ravages of the elements, which involved the protection of the vested rights of those who had acquired title to lands through operation of the public land laws. This created conditions beyond the capabilities of the average contract surveyor and necessitated the development and training of a corps of specialized surveyors to handle the problems.

By the time of the conversion of the contract to the direct system, much of the arable land area and the areas for which need could be foreseen had been surveyed. As might be expected from a program of this magnitude, which extended over a period of more than 120 years and stretched from the Appalachian Mountains to the Pacific Ocean and from Canada to the Gulf of Mexico, some irregularities had crept in. Undoubtedly, some of the reported surveys in the rougher and more remote regions were more or less fraudulent. However, surveys of that character are but an infinitesimal portion of the total and cannot be permitted to influence the judgement as to the accuracy and integrity of those men who braved the wilderness in the early days of the history of this country for the purpose of creating land boundaries to enhance and speed the development of the Nation.

Under the contract system, the corner position monumentation was by the most durable native material available. This could have been marked stones, stakes, living trees, or other material thought to be adequate for the purpose. Such monuments are subject to deterioration and disappearance through natural causes. In many cases the surveys were made years and years in advance of settlement or before the land became economically desirable for other purposes. During that lapse, much could and did happen in the way of destruction of corner monuments. I am convinced that in many cases the charge of fraudulent survey has been incorrectly made whereas, in reality, the absence of identifiable corners is due to the lapse of time since the survey was executed.

Since 1910 the survey corners have been monumented with wrought iron galvanized posts having a brass cap on which the corner marks are stamped. It is the expectation that, with the exception of areas of the most adverse soil conditions, this type of corner monument will last for 100 years or more. I may say, however, that we have not abandoned thought of an even more permanent corner marker and are continuing our search for suitable material.

An important economic advantage of the rectangular scheme of surveys is that the lands are ordinarily disposed of in square units or legal subdivisions of 40 acres each. The land record in the counties of the public land States can thus be entered easily and maintained on printed and uniform size diagrams of township plats. The title records are much more complicated and involved in the older areas where the records must be compiled from innumerable irregular and uncoordinated survey records.

From the standpoint of land economics, the disposal of land in blocks, which entailed the taking of the bad with the good, has resulted in the highest use of the whole. This was a bitterly-opposed feature of the original land ordinance and the wisdom of the course was slow to be appreciated. Naturally the settler wanted all of his holdings to be good land and objected to having what he considered as worthless hills, swamps, or poor land included in his settlement. However, experience has proven that, once it was his, he made every effort to utilize it all to the best advantage—the hills have become woodlands and pasture; the swamps and sloughs have been drained or filled, where posible; and the rocky or poorer land may have been used as home or barn sites. With the settlement of the country and increasing value of land, new uses and new demands have been made for even the scattered and isolated tracts of unattractive land

in the areas of the earliest settlement. As a result, much land that once had only marginal economic value has been transferred to private ownership in units of manageable size and character, thus eliminating the endless administrative problems incident to Federal management of those scattered tracts.

You will recall that the 1805 act established the finality of the corners and lines of the public land surveys. As a result, in spite of the intense development of much of the area covered by those surveys, the lines and corners are still preserved as corners and boundaries of the privately owned land. This is demonstrated emphatically in air travel over the agricultural areas of the Midwest where the fields still conform to the lines of the early surveys. Even in such metropolitan areas as Chicago, the townsite subdivision is controlled by the section lines of the original public land surveys—streets are laid out along those lines and the public land survey corners have been perpetuated and buried beneath the pavements.

As to accomplishments, I have indicated that the rectangular public land surveys have been extended over the public lands from the Appalachian Mountains to the Pacific coast and from the Canadian border to the Gulf of Mexico. Statistically, approximately 1 billion 330 million acres in the continental United States have been surveyed. Only a very small portion of Alaska has been surveyed, but the surveys in that Territory are being extended as rapidly as necessary to anticipate the needs of settlement and industry.

The present corps of cadastral surveyors in the Bureau of Land Management is engaged principally in the execution of three classes of surveys in the continental United States;

1. The execution of original surveys in regions so fantastically rough and broken that until the discovery of uranium and petroleum in relatively recent years, it was not believed that there would ever be a need for their survey. In some of these areas it is necessary to transport survey crews by helicopter in order to accomplish the required surveys.

2. The resurvey of early surveys and identification of the boundaries of remaining public lands for the proper administration of those lands which have become increasingly valuable with the settlement and development of the country.

3. The resurvey and remonumentation of the boundaries of areas subject to intensive development—such as reclamation projects.

There are large areas of unsurveyed public lands included in permanent reservations, such as National Forests and National Parks, in which the extension of the public land surveys probably never will be required. However, there are some 175 million acres of public lands still under the jurisdiction of the Bureau of Land Management. It is estimated that much of this area will require resurvey to permit effectual management of the land and resources. There are very extensive areas where, due to deterioration of corner monuments, there is uncertainty as to position of boundaries between Federal and privately owned lands, wherein the services of our surveying organization are urgently needed to settle matters of trespass. While it is improbable that all of Alaska will require survey, there are very extensive areas suitable for settlement and development in that Territory which must be surveyed to develop their full potentialities. All of these mount up to a very considerable program of survey and resurvey of the public lands which will require many years for completion.

Looking back over the years, one who has been closely connected with the public land survey system cannot help but admire those who conceived the plan and put it into operation. The names of many, such as Hutchins, Mansfield, Meigs, Tiffin, Freeman, Ellicott, and William Burt and his four sons, come to mind as those who have contributed so largely to the successful inauguration and prosecution of this system. Designed originally to mark on the ground the boundaries of tracts of land for settlement and development of the wilderness, the public land survey system of the United States has been and is a marked success.

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Wisconsin Society Ponders County Surveyor Question

EDITOR'S NOTE.—From the November 4, 1957, issue of the *Newsletter* of the Wisconsin Society of Land Surveyors we learn that that Society is, and has been for some time, exploring the question of revising or rewriting the State statutes concerning county surveyors. The following paper by R. P. Boyd, former director of the Society, appeared in the *Newsletter* mentioned above. It is reprinted here because it presents at least one thoughtful man's suggestions as to the solutions of problems which are facing many counties the country over.

The County Surveyor

AT THE TIME when the present statutes regarding the county surveyor were written, a large part of our State had no surveys excepting the government surveys, which had set wooden stakes, generally with blazed witness trees, for section and quarter corners only. With the advent of more and more settlers, farms were developed, and surveys were necessary for the location of roads, property fences, and for property lines for lumbering. The county surveyor then was a busy man with his surveys for new roads, and other work, partly for the county or town, and partly for individuals. He usually was not a technically educated man, having acquired his knowledge of surveying from work as a chainman or helper for a more experienced surveyor. However, he did valuable service, and many monuments now accepted as being the section or quarter corner owe their existence to the conscientious efforts of these old county surveyors. Although much of their work would not meet present day standards of accuracy, having been done with the magnetic compass and the Gunter chain (the link chain), as a rule they were meticulous in their search for original monuments, and thus rendered priceless service.

At the present time we find a vastly changed situation, with widely different conditions in different parts of the State. Much of the northern part is still wild land —forest and game preserves, resort and lake property, or cutover timber land—a considerable amount being submarginal and of low economic value. The process of attrition has caused many section and quarter corners to vanish. Makeshift surveys, particularly in section subdivision, were made which were not in conformity with Federal procedure, usually because the land values did not justify a more complete and authentic survey. However, these old surveys have been the basis for long established occupancies which the courts are very loath to disturb. There is no over-all monumented and recorded grid system as such.

At the present time some counties have no county surveyor; others have one who does little if any work. Many counties appropriate only a token amount, sometimes under a hundred dollars, for the county surveyor's office. Many counties have no county surveyor's office or records in the court house. In some counties, however, there has been a worthwhile practice under a competent county surveyor, which has made his office a valuable compendium of old survey notes, maps, and records, with section and township maps brought up to date, showing all existing survey information. The counties, in these cases, have provided sufficient office space, filing cabinets, and clerical and drafting help, and have paid the competent county surveyor or deputies a reasonable compensation. Dane County is an example of this type.

A few other counties have made appropriations to cover the reestablishment or relocation of lost or obliterated government corners when required to facilitate a private survey which would otherwise be prohibitively costly to the owner. However, in most counties of the State the old monuments are steadily vanishing through the

ravages of highway improvement, and lack of preservation and recording. The county surveyor, if there is one, has a more or less complete file of existing monuments, but this is his stock in trade, and he does not wish to make this available to his competitors in the survey business, because their information is not available to him, and because little if any of this information has been derived from work for which the county has paid.

So, in many cases the office of county surveyor is occupied by a surveyor who derives no direct revenue from the office, and its only value to him is the questionable prestige of that title in securing private work. In private surveys, the work done by a county surveyor stands on an equal footing with the work done by any other surveyor, being of value through its competence, not from the official position of the surveyor.

At the present time many well informed surveyors and engineers believe that the office of county surveyor, under our existing statutes, has outlived its usefulness, particularly if it is an elective office with no restriction as to qualifications. Professor Ray Owen, formerly head of the surveying department at the University of Wisconsin; has often told of receiving a letter saying, "I have been elected county surveyor. Please tell me where I can buy a surveying instrument and a book on surveying." In my home county a few years ago, the incumbent, a competent surveyor, was a Republican. There apparently being no surveyors in the Democratic ranks, a middle aged hotel keeper was induced to accept the Democratic nomination, in spite of the fact that he probably did not know the north end of a compass from the south end of a horse. Fortunately, the incumbent won, but if there had been a Democratic landslide of straight-ticket voting the office of county surveyor would have been as vacant as if it had been abolished by statute.

The first question to be resolved is, therefore, should the office of county surveyor be retained? Before doing a mass of work on a proposed new statute on county surveyors, perhaps it would be wise to study the overall situation in many counties where there is no county surveyor, or where it is a title only. To meet the desires of those counties in which a competent county surveyor is operating, an alternative might be developed under which existing staffs and methods of operation could be retained, but as an appointive office. There is a legal question as to whether the appointive provision would be possible without a constitutional amendment. Many well posted surveyors, perhaps a majority, believe the elective system to be the most practical.

So, in keeping with the principle of "first things first," I suggest the following questions for discussion:

1. Shall the office of county surveyor be abolished, or retained with modifications as to duties, powers, and compensation?

2. If abolished as such, what provision will be made for those counties now actively supporting constructive work by their county surveyors?

3. If retained, should not the entire statute be rewritten, instead of attempting to revise the present antiquated statute?

4. In either event, what statutory revisions are necessary to insure that the Wisconsin Statutory Procedures as to surveying are in full conformity with the Federal procedures?

5. Would it not be well to provide for confirming the integrity of existing landmarks and monuments, either as a part of the statute revision, or as a new statute not included in the county surveyor statute? This might cover locating, mapping (with adequate ties), advertising for hearing, and a provision for recording and final acceptance after a waiting period of, say, two years if not attacked by court procedure during that time. It is important to preserve these old landmarks, to have ample ties and recording, and to have a provision whereby their integrity is legally established.

Without attempting to cover the field in detail, which would require the efforts of a group of men active in various parts of the State and under varying conditions, I list below only a few items for consideration:

1. In counties in which there is no registered land surveyor, or where none is available for the office, make it permissible for

the position to be held by a nonresident surveyor, who might act as county surveyor for several adjacent counties.

2. The office of county surveyor should be held only by a registered land surveyor and should be filled by appointment by the county board, rather than elective. (And listen to the would-be politicians grind their teeth.)

3. Certain guarantees should be worked out covering such items as adequate office space, clerical or drafting help (on county work only, of course), and a minimum annual payment for county work. Certain phases of this should be optional, rather than mandatory, as a hardship must not be worked on the poorer counties.

4. Make the county surveyor the enforcing officer on provisions covering landmark destruction, preservation, or relocation, with adequate compensation from the county and with power to initiate action through the District Attorney on any case of willful or negligent destruction of landmarks, whether by an individual or by a political division or its agent. A revision of the statutes on this is definitely indicated. What is everybody's business is nobody's business, so the responsibility for the enforcement of this statute should stem from the county surveyor, with due support from other surveyors.

5. Develop some simple, workable, and efficient system of tying in and properly recording old landmarks.

6. Develop, probably by a separate statute, a means whereby it will be mandatory for every registered land surveyor making a land survey (not an engineering survey) to record a survey map with pertinent distances, angles, ties, monuments found and set, etc. This could be recorded with the register of deeds or with the county surveyor as deemed most advisable, and properly filed and indexed. This would require adequate compensation, probably as part of the survey fee, to be paid by the owner. Survey maps made prior to the statute, but in conformity thereto, would be entitled to be recorded. This should not conflict with or attempt to supplant the recent statute on "certified surveys," and would apply to the county surveyor as well as to private surveyors.

7. The rate of compensation for the county surveyor should be set by the County Board, and would probably vary in different counties. This would apply only to services performed for the county or town and not to private surveys.

8. It has been suggested that all surveys under the above be referred to the true meridian. It must be recognized that in some areas a nest of small metes-and-bounds descriptions based on some arbitrary datum have developed over the course of many years. New descriptions based on true meridian would not be congruent with the adjacent descriptions and would create much difficulty for attorneys, abstractors, and tax officials, by showing apparent gores or overlaps not existent on the ground.

If the true meridian is required it may be expected that the cost of the survey will be relatively higher. In cases where there are existing adjacent descriptions, the bearings of which are based on an arbitrary datum, these could be retained for description purposes, and the equation between the arbitrary datum and true north shown on the survey map or in the description. Use of "declination" or magnetic bearings is to be frowned upon, except in some special cases. If true meridian is made mandatory, then by all means insist that the State Highway Commission shall determine the true meridian of all State highways and place a map on record in the county seat showing true meridian for all State highways within the county. In many cases this would eliminate the Polaris or solar observation and lessen the cost.

9. Standard monuments should be specified for section and quarter corners, and also a minimum standard for corners on property surveys.

10. Metes-and-bounds descriptions should be drawn only by a registered land surveyor. The statute should roughly parallel existing statutes which reserve to attorneys the right to draw deeds. If the attorneys object too strongly to this, let them tear down part of

their own fence and allow registered land surveyors to draw deeds of property which they have surveyed.

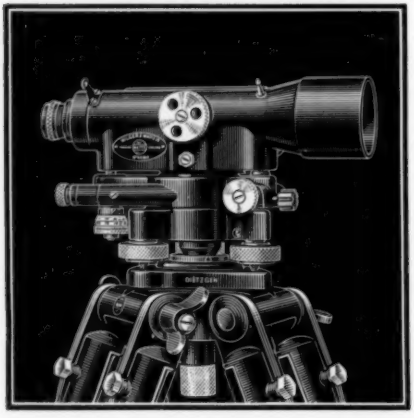
The above are only a few of the questions which will arise. Many more will develop during discussion and in preparing the statute revisions or the new statutes.

(Continued from page 212.)

Washington State Advisory Board for Surveys and Maps," "Comparison of Design and Operation between the Geodimeter and Tellurometer," and "Annotated Bibliography on the Geodimeter and Tellurometer."

A complete and up-to-date set of all horizontal and vertical control established in the State of Washington both by the U. S. Coast and Geodetic Survey and by the U. S. Geological Survey is kept in the Bureau. All inquiries asking for data on the control points established by these agencies in our State and in western Idaho and northern Oregon will be promptly processed.

The Bureau is assisting the University of Washington Geography Department in constructing an azimuthal-equidistant world map centered on Seattle-Tacoma International Airport. This map will show exact great-circle distances and azimuths from SEA-TAC (and near exact from any point in Washington) to any other place in the world. Calculations for this map on IBM cards of 2,810 intersections of parallels and meridians was started by the University and will be completed by the Bureau. The maps will be finally completed in the cartographic laboratories of the University.



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Enforcement of Surveyor Legislation

By COL. PAUL J. DOWLING

LICENSED LAND SURVEYOR, CALIFORNIA

EDITOR'S NOTE.—The following paper was presented by Col. Dowling as official representative of the Northern California Section, ACSM, at the 47th Annual Meeting of the County Supervisors Association of California and the 42nd Annual Meeting of the County Engineers Association of California, held jointly at Santa Rosa, Calif., Sept. 18–20, 1957. Col. Dowling, who was at that time a director of the Section, spoke as part of a five-member panel which had as its subject, "The California Engineers and Surveyors Act—What Can Be Done to Attain Enforcement?"

THE OBJECTIVES of the Northern California Section of the American Congress on Surveying and Mapping, in its contribution to the enforcement of the California Land Surveyor's Act, are: organization, education, and fostering a spirit of mutual helpfulness among surveyors.

Until recent years surveyors were one of the few groups in professions or labor remaining unorganized. The grass roots of surveyor organization has been the ACSM and its excellent magazine, SURVEYING AND MAPPING. It has partially overcome the isolation under which surveyors have worked and which prevented their combining. In the whole country labor organized, physicians organized, attorneys organized, and architects organized, yet surveyors never could seem to understand that group interest is self interest.

There never seems to have been much pro bono publico spirit among surveyors to work for the commonweal. In fact, we have observed that some are willing to appear in court and testify that their fellow surveyor's work was all wrong in fact or method. Who ever hears of a physician doing that? Would it inspire public confidence in their group if they should? But a few surveyors have been casting a blight on themselves and their coworkers by doing just this. And the Northern California Section of ACSM is against this, except in cases of actual wrongdoing.

ACSM leaders in California believe that by bringing surveyors together they will be able jointly to study the Land Surveyor's Act and, perhaps, point to ways of further simplification. This has been under discussion at Monterey, Santa Barbara, and other Section meeting places for some years. In passing, I believe that the inception of the eight associations of the California Council of Civil Engineers and Land Surveyors was in the Congress meetings.

One result of ACSM Section meetings has been the changes in the requirements of records of survey. While county surveyor of Monterey County, our moderator, Sam Black, worked toward their modification. This has resulted in reducing the number of certificates and permitted their being printed on linen. He also promoted a reduction in the margin requirements which were a waste of map space. For the first time California ACSM members were urged to contact their State senators and legislators to state their views on laws affecting them. The effect has been gratifying, but we have far to go.

There is a tendency in county and city government to increase the requirements of private engineers and surveyors in most work such as subdivisions and records of survey. We ACSM members believe officials should ask themselves, before making a new requirement, "Is this work really necessary?" In some cases, a subdivision map must now pass through seven county offices before filing.

Surveyors feel that some of the work required is like the mule the Georgia farmer bought at the stock auction. Seeing a likely looking mule on the line he asked the dealer the price and if the mule had any known faults. The dealer replied, "The price is $300. He does have a couple of faults." The farmer asked what the faults

were and the dealer said, "Well, if you will buy him I will go 50-50 with you. I will tell you one fault before you pay me and the other after you pay." The farmer thought it over an said, "All right, I will take him. What is the first fault?" The dealer responded, "That mule is hard to catch. It takes three men to corner him in the pasture." The farmer thought this over and said, "I'll take him, and I'll fool him. I'll keep him tied. Here is your $300. Now what is the other fault?" The dealer replied, "That mule is no damned good after you do catch him."

Surveyors and civil engineers often feel that the requirements of some city and county officials are like the Georgia mule—of no particular value after being caught and sometimes irrelevant to the case in point.

In northern California, through the efforts of C. A. Wooldridge, Harley Waterfall, and others, meetings of the ACSM have been extended over one hundred miles from the Bay Area. They have sent out good speakers to the Sonoma-Lake-Mendocino County Association, such as Prof. Frank Moffitt of the University of California and Prof. C. J. Aggeler of City College of San Francisco.

At our Surveyors Workshop in Monterey last May, the directors voted to send some of our officers to organize meeting groups in the northern and northeastern counties of the State. One of these meetings is being held for Humboldt-Del Norte Counties this month in Arcata. It was sponsored by County Surveyor Charles H. Shaller, and the ACSM is sending Prof. C. J. Aggeler of City College and William Angeloni, Corps of Engineers, as speakers. The latest roster shows that the ACSM has six members in Eureka, two in Arcata and a few more in more remote places.

The Congress has some advantages in membership over other organized groups. For instance, you county surveyors can belong, but you cannot be in the California Council. We can enroll all persons employed in surveying, including women. And they also vote. There are now nearly six hundred ACSM members in California.

Turning briefly to the Congress' educational program, the Northern California Section is sponsoring extension courses this fall and winter in Berkeley, San Francisco, Redwood City, and Santa Rosa. These are mostly for party subordinates. For the past two years, we have publicized and sponsored the excellent courses at the University of California in Survey and Title, with William C. Wattles as instructor.

An attitude of mutual helpfulness is sorely needed among surveyors. In our local area this has been promoted by holding quarterly dinner meetings with a speaker. Whenever a group sits down to cocktails and dinner together they discover their mutual interests and that they have problems requiring group effort. They also discover and talk over where bad survey conditions exist and where collections are slow or difficult. The county surveyors are requested to speak and make their wants known.

Several of our younger surveyors feel that we should have a central map depository and filing clerk, with each surveyor turning in every map and sketch he makes. This would be closed to all except licensees and would soon be vastly superior to the assessor and escrow maps. It would expose most questionable areas and save all untold hours of search and exploration.

IT IS NOT TOO EARLY TO BEGIN PLANNING TO ATTEND THE 1959 MEETINGS

Surveying and Mapping News

Members are requested to send in surveying and mapping news items for publication in SURVEYING AND MAPPING.—EDITOR.

CURRENT SURVEYING AND MAPPING LITERATURE

MAGAZINE ARTICLES

General Interest

THE NORTH KIMBERLY SURVEY AND MAPPING EXPEDITION, 1954. R. V. Bayliss. *The Australian Surveyor,* Vol. 16, No. 7, September 1957. (A review of the report of John F. Morgan, leader of the expedition.)

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MASKING HAS CHANGED. John Pince. *National Lithographer,* Vol. 65, No. 4, April 1958. (Discusses new methods in color separation masking.)

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—LYMAN D. LYNN
Coast and Geodetic Survey

DISTINCTIVE RECENT MAPS

Economie Mundiale is a new economic map of the world published by Kümmerly & Frey, Berne, Switzerland. The map, designed for use in secondary schools, was compiled by Prof. Hans Boesch, with the assistance of A. Behrens, M. Müller, and F. Casatello. It is accompanied by an explanatory booklet printed in French. The map measures 30 by 49 inches and has an equatorial scale of 1:32,000,000.

The picturesque grandeur of the mountain regions of western United States can be realistically portrayed by modern methods of relief shading. In recent years, the U. S. Geological Survey has happily made effective use of this technique for maps of the individual States and of unique scenic features.

A recent addition to the Survey's growing list of attractive and useful maps is the *State of Colorado* published in 1957 at the scale of 1:500,000. The interesting contrasts in relief between the plains of eastern Colorado and the ranges and valleys in the central and western part of the State are clearly and graphically depicted by the skillful use of color and shading. In addition to relief the map shows county boundaries, drainage, and a number of inhabited places. It measures 42 by 54 inches. Copies of the Colorado map, at $2.00 each, may be ordered from the U. S. Geological Survey, Washington 25, D. C., or U. S. Geological Survey, Federal Center, Denver 15, Colorado.

The *Topographic Map of the Grand Teton National Park,* published by the Survey in 1958, also employs the shaded relief technique. The map, which is at the scale of 1:62,500, shows the hills and valleys of this rugged mountain region in a most striking manner. On the verso of the shaded relief edition, (as well as on the contour edition of the same area, first published in 1954) there is descriptive information, diagrams, panoramic views, a generalized west-east cross section through the Alpine portion of the Teton Range and Jackson Hole, and a short account of the geology, geography, flora, and fauna of the National Park. Copies of the Grand Teton map, which measures 50 by 33 inches, may be ordered, at $1.00 each, from either of the Geological Survey Offices noted above.

Resources and highways of Wyoming are features on several new maps. *State of Wyoming Map Showing Irrigation aand Power Development* was compiled and published in 1956 by the Natural Resource Board in cooperation with the State Engineers Office. It is at the approximate scale of 1:850,000 and measures 25 by 28 inches. It shows actual and potential irrigated land, existing and potential reservoirs and lakes, and existing and projected power plants and transmission lines. The Wyoming Highway Department in cooperation with the Bureau of Public Roads, U. S. Department of Commerce issued in 1957 a highway map of the *State of Wyoming.* The scale is 1:1,000,000 and the size 17 by 28½ inches. Drainage, cities and towns, boundaries, airways, and railways are shown, as well as several classes of roads.

The same cooperating organizations are responsible for a *Traffic Flow Map of the State of Wyoming* which shows total and foreign motor vehicle average daily traffic for the year 1956. It is the same scale and size as the highway map. There are enlarged inset maps of the environs of Powell, Sheridan, Torrington, and Cheyenne.

The New World—1600 is an attractive and colorful facsimile issued as a supplement to the December 1957 issue of *American Heritage* magazine. It was reproduced from an original map prepared by Gabriel Tatton and engraved by Benjamin Wright. The translated title of the map reads "A new and recent delineation of the lands and kingdoms of California, New Spain, Mexico and Peru, together with an exact and absolute representation of the Gulf of Mexico to the island of Cuba and as far as the shores of the southern sea." First published in 1600, Tatton's map provides a good record of what was known of the southern half of North America a century after Columbus landed in the New World. The facsimile measures 18½ by 23½ inches.

The Library of Congress published recently an attractive facsimile of *Captain John Smith's Map of Virginia, 1612.* Copies, at $1.75 each, may be ordered from the Card Division, Library of Congress, Washington 25, D. C. The collotype reproduction, which measures 16 by 19 inches, is on fine, imported paper, and is suitable for framing. An accompanying brochure relates the history and significance of the map.

A Literary Map of Ohio is a colorful, pictorial presentation of Ohio's literary heritage. It was designed by Mark M. Russell and copyrighted in 1957 by The Martha Kinney Cooper Ohioana Library and the English Club of Columbus, Ohio.

Orders, at $1.50 per copy, may be addressed to either of these organizations in Columbus, Ohio. The map measures 23 by 35 inches. No scale is given.

Agricultural Regions of Canada is a 1956 publication of the Geographical Branch, Canadian Department of Mines and Technical Surveys. The scale is about 1:3,330,000. The eastern and western agricultural regions of the country are shown on separate maps which share the same sheet. Ten agricultural types are distinguished within four major groups, "Livestock Speciality," "Grain Speciality," "Special Crops," and "Combination Grain and Livestock." A graph showing "Generalised Distribution of Agricultural Regions by Province" is inserted on the map sheet, which measures 32 by 41 inches.

Luftstrassen und Funkeinrichtungen presents airways and radio facilities of West Germany. It was published in 1957, at Frankfurt am Main, by Bundesanstalt für Flugsicherung. By means of color and symbols, air defense identification zones, advisory areas (CSR), magnetic tracks, minimum IFR cruising levels in feet, distances between two reporting zones, and military control areas are delimited. The sheet dimensions are 20 by 27 inches.

The Ministry of Geology of the U.S.S.R. published in 1956 an 18 sheet *Geological Map of the U.S.S.R.*, at the scale of 1:2,500,000. Each sheet measures 32 by 26 inches. The title, credits, and legend are on a separate sheet (in English). More than a hundred different formations are shown by color and letter designations. Compilation was under the direction of L. P. Kolossova, S. A. Musylev, and V. N. Vereshshagin. D. V. Nalivkin served as Editor-in-Chief and was assisted by A. P. Markovsky and E. T. Shatalov. Information and data used in compiling the map were supplied by a number of scientific and engineering groups within the U.S.S.R.

The continued output of maps of the various political entities of Africa reflects the increasing importance of the one-time "Dark Continent" in world affairs. *Mantnieks Congo Belge* is the second edition (1956) of a detailed and informative physical-political map of the Belgian Congo. It is copyrighted by Institut Cartographique P. Mantnieks and published by l'Office International de Librairie, 30 Avenue Marnix, Bruxelles. The map, which is at the scale of 1:2,500,000, shows generalized relief by color gradients and shading. Major roads, railroads, and air routes are indicated, along with political boundaries and populated places. A detailed alphabetical index, in booklet form, accompanies the map. The map sheet measures 36 by 46 inches.

Institut Geographique du Congo Bèlge published in 1956 *Carte Routiere Officielle de la Province de l'Equateur* and *Carte Routiere Officielle de la Province du Kasai*. Both of these road maps are at the scale of 1:1,000,000. The former measures 38 by 37 inches, and the latter is 28 by 34 inches. Several classes of roads, internal administrative boundaries, railroads, and populated centers are shown. Distances in kilometers are given between road intersections.

Kenya—Political & General is a two-sheet map at the scale of 1:1,000,000. It was compiled and published by the Survey of Kenya (Nairobi) in 1957 (2nd edition). In addition to the customary data, the map shows different categories of forest land, national reserves, highlands, and native reserves, leasehold areas, and land units. An annual rainfall map is an inset on the map which measures 50 by 36 inches when the two sheets are joined.

Mean Annual Temperature Rhodesia and Nyasaland is a 1957 publication of the Director of Meteorological Services, Salisbury, Rhodesia. Five thermal regions are differentiated by different colors. The scale is 1:5,000,000 and the dimensions are 14 by 12 inches. A small inset map shows the Basic Network of Temperature Stations.

The island of Madagascar is the subject of several recently acquired maps. Generalized relief and cultural details, as well as aeronautical information, are presented on the six-sheet *Carte de Madagascar au 1:1,000,000*. It was designed and published by the Survey of Madagascar in 1949. Each sheet measures 30 by 22 inches.

Madagascar Carte Géologique is a 1952 publication of the Service Géographique de Madagascar. The map, which is in three sheets and at the scale of 1:1,000,000, was compiled under the direction of Henri Besairie. It is based on the surveys, studies, and reports of a number of geological investigators. Formations ranging in age from pre-Cambrian to Pleistocene are shown. Each of the three sheets measures 25 by 35 inches.

The Service Géographique de Madagascar published in 1951 a two-sheet *Carte Ethnographique de Madagascar* at the scale of 1:1,500,000. Twenty ethnographic groups are differentiated by color designations. Pie-graphs show racial percentages for a number of cities on the island.

By the same publisher are an administrative map and a hypsometric map of *Madagascar and Comores* at the scale of 1:2,500,000, both issued in 1950. The latter presents relief by means of the standard combination of contours and color gradients.

—WALTER W. RISTOW

Library of Congress

Books in Review

ROUTE-MAPPING AND POSITION-LOCATING IN UNEXPLORED REGIONS. W. Filchner, E. Przybyllok, and T. Hagen. *Academic Press Inc.*, New York, 1957. 288 pages.

The book comprises three parts by the above authors, respectively, as follows: First Part—"Method of Route-Mapping;" Second Part—"Position-Finding and Altitude-Measurements;" and Third Part—"Route-Mapping and Topographical Surveys with the Aid of Photographs."

Method of Route-Mapping

The author has here presented a highly detailed treatise on Route-Mapping in the warm lowlands and the frigid highlands of the unexplored regions of Asia. One cannot read this first part of the book without gaining a distinct impression of the author himself as a man intensely devoted to his subject, untiring in his zeal to leave no stone unturned to insure the success of his expedition, and yet kindly and considerate toward both the men and the animals in his caravan. His remark, "and finally: treat your animals as good friends; your work will be all the better for it," is sound advice.

The author is a strong disciplinarian and a stickler for doing the smallest thing in the right way. Note the instructions to his men to keep an eraser "in the right-hand coat pocket," not to remove one's glasses "when riding at a walking pace," but to "push them off your nose over your forehead where a rubber band will keep them fixed, and put them back onto the bridge of your nose when working," and to put your wrist watch "under your pillow; in the morning, put it on before rising, so that it cannot get lost." The above quotations are cited as examples of the minutiae which prevail throughout the instructions. It is apparent that the author determined to make available to the neophyte the fullest information from the wealth of his own vast experience to avoid for him even the small mistakes which, as those who have led such enterprises know, can often spell the difference between a mediocre and a highly successful expedition. To permit the new man to learn from his own experience is too often the attitude of the older man who has learned the hard way, but the author obviously believes that the new man should start where experience leaves off and superimpose on that any new lessons he may learn and initiative he may develop.

The later and more technical chapters of Part I, dealing with altitude determinations, time signals, and meteorological instruments, are models for precise description and clarity of presentation.

The first part of the volume by Wilhelm Filchner is at once entertaining and highly instructive; it should be read and digested in detail by anyone who contemplates route-mapping in unexplored regions of the world.

Position-Finding and Altitude-Measurements

The author of the second part of this book, Dr. Przybyllok, unfortunately died before he could complete his work. However, his contribution is a most lucid description of practical methods for finding one's latitude and longitude on the earth's surface and the approximate elevations of desired features. His illustrations are among the best for clarity and appropriateness. The young astronomer or surveyor engaged on route-mapping or reconnaissance would do well to study these chapters thoroughly; from them he should add materially to his basic knowledge of how to find rapidly his geographic positions and elevations with an accuracy adequate for his purposes. He is told how to employ the method of position lines from zenith distance and azimuth observation, determine his local time, and elevations from barometer and spirit leveling; he is given also a treatise on the theodolite and its use, along with many practical suggestions as to what to do and what to avoid doing in the handling of a theodolite.

Route-Mapping and Topographical Surveys with the Aid of Photographs

The author of the third part of this book, Dr. Toni Hagen, calls attention to photography, a relatively new and highly valuable tool of the route-mapper which has appeared in recent years. He discusses at length both aerial and terrestrial photography, and the underlying principles on which each type is converted from a picture to a usable map. He defines and points out the relative values of the oblique, the vertical, and the trimetrogon photographs, the cameras involved, and the limitations of each type of photography.

If a portion of Part III may be selected as more outstanding than any other, it is believed to be the section in which the author deals with the interpretation of aerial photographs. The quantity and diversity of information available to an expert from the study of aerial photo-

graphs cannot be appreciated by the layman or even the average engineer. It is obvious that the trained interpreter not only can determine surface features but can "see" beneath the surface. By analyzing the appearance of vegetation, he can determine types of soil and rock, the location of anticlines with their relative potentialities as to the presence of oil bearing strata, the existence of archeological structures, and other information so vast that a complete study of this section of Part III must be made to appreciate the knowledge obtainable from expert interpretation of aerial photographs.

Summary

The three eminent authors of *Route-Mapping and Position-Finding in Unexplored Regions* have produced an entertaining, illuminating, and factual book. It combines romance, instruction, and a wealth of detailed information on a subject not too widely covered in the past. It cannot be commended too highly, both to the young and to those who rate themselves experienced in the profession.

FLOYD W. HOUGH

EDITOR'S NOTE.—Dr. Filchner, author of Part I of *Route-Mapping and Position-Location in Unexplored Regions,* died May 7, 1957.

LOCATION AND SPACE-ECONOMY. Walter Isard, Technology Press of Massachusetts Institute of Technology. *John Wiley & Sons, Inc.,* New York; *Chapman & Hall, Ltd.,* London, 1956. xix + 350 pages. $8.75.

Although the author addresses himself, in this book, primarily to sophisticated students of economics, he deals with a subject of interest to persons concerned with maps and mapmaking, namely, the impact of locational and spatial factors on economic activity.

The book begins with a discussion of a hypothetical region which is gradually settled and developed. The region is described as it progresses from primitive agriculture to modern, complex land use. The author indicates that spatial factors are especially significant in the examination of market areas, population distribution, and transportation. There follows a review of existing literature on location theory and spatial economics. The remainder of the book consists of a detailed exposition of the author's conception of the subject.

Probably his most significant contribution is a mathematical formulation of location theory. He also shows numerous similiarities between different aspects of location theory and other branches of economic theory.

The concepts reviewed and developed by Professor Isard have application in the various fields which require regional planning or analysis, such as industrial plant location, highway system planning, urban renewal, and market analysis.

The book is liberally illustrated with charts and curious map-like diagrams to portray theories on land-use, market areas, and population distribution.

Location and Space-Economy is considered a distinguished book on economic theory. Its numerous references to economic literature presume a detailed knowledge of economic theory not likely to be at the disposal of the nonspecialist reader. Professor Isard recognizes the need for a less abstract treatment of the subject for general use and is currently engaged in this project.

LAWRENCE FAHEY

Ford Instrument Company,
a Division of the Sperry Rand Corporation

NOTEFORMS FOR SURVEYING MEASUREMENTS. Russell C. Brinker and Brother B. Austin Barry. *International Textbook Company,* Scranton, 1957.

Noteforms for Surveying Measurements is a loose-leaf booklet designed to fit in such standard six-ring binders as the K&E 390. It contains a title page and preface which take up pages i to iv, inc.

Pages 1 to 8, inc., titled "Surveying Field Notes," contain general comments on the subject, requirements of good notes, types of field books, kinds of notes, arrangement of notes, and suggestions on recording notes.

The remainder of the publication, some 86 pages, contains, in photolithographic form, samples of original field notes of many different types, from referencing hubs to observations on Polaris.

Not all of us will agree that each and every sample of field notes shown is the best possible form of record, but it is a very safe bet that if more surveyors would follow the suggested forms the net result would be better field notes and less chance of confusion, both in the field and the office. For the student surveyor this should furnish a very valuable guide to the making of clear and complete survey field notes.

HOWARD S. RAPPLEYE

EARTH FOR THE LAYMAN. Mark W. Pangborn, Jr. *American Geological Institute,* 2101 Constitution Avenue, N.W., Washington 25, D. C. 1957. 68 pp. $1.00.

This useful bibliography lists 1,370 titles of books and pamphlets which "involve general understanding of the earth sciences, or which can be of practical assistance to the amateur earth scientist." The titles are classified in two major groups (1) "Earth Science, by Topics," and (2) "Regional, by State." The first includes eighteen subject subdivisions, each of which has additional breakdowns.

Of special interest to cartographers and cartophiles are references on Map Makers (49 titles), Mapping Novels (4 titles), and Maps (27 titles).

WALTER W. RISTOW

Library of Congress

Life Carries Feature Article on Geodesy

The May 12, 1958, issue of *Life* contains a feature article on geodetic surveying, under the eye-catching title "The Missile-Era Race to Chart the Earth." Based principally on the work of the Army Map Service in closing the African gap in the 30th Meridian arc of Triangulation from Norway to South Africa, the article also covers, in popular fashion, the parts that astronomy, gravity, satellites, Hiran, the Tellurometer, etc., play in studies leading to better knowledge of the size and shape of the earth and in the production of accurate maps and charts of the world.

ACSM member Floyd W. Hough comes in for the principal individual attention in this article, especially in connection with his work in gathering geodetic data in Europe, which eventually made possible a unified geodetic datum in that area where formerly much confusion resulted from each country having its own independent datum.

This article is recommended reading, even for geodesists, and the general public should derive from it a much better understanding of what the geodesists hope to accomplish.

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A progress report—

Glen Canyon Dam Project to open vast new area

Work on huge Upper Colorado River Project well under way

When completed some six years hence, the giant Glen Canyon Dam, Reservoir and Powerplant Project will unlock the riches of a vast, 10,000-square-mile area.

The high concrete gravity arch dam, rising 700 feet from bedrock, will contain 5,493,000 cubic yards of concrete. Power from the 900,000 KW power plant, located 470′ downstream from the dam, will make possible the development of huge resources of fuel, oil, minerals—including uranium—and timber.

When filled to capacity the 28,000,000-acre-foot reservoir will stretch 186 miles up the Colorado and 71 miles up the San Juan, a major tributary of the Colorado. Basically, this project is for river control and power generation.

Largest single dam contract on record

The $107,155,222 contract for the Glen Canyon Dam and Powerplant, largest ever awarded by the U.S. Bureau of Reclamation, went to Merritt-Chapman & Scott Corporation, New York. On April 29, 1957, the day the contract was awarded, Merritt-Chapman & Scott signed a contract with Fairchild for aerial mapping of the dam site, reservoir and areas adjacent to the dam site. Flying operations began on May 5, *just six days later!* Advance copies of the flying results were delivered on May 26. Other detailed data followed soon after.

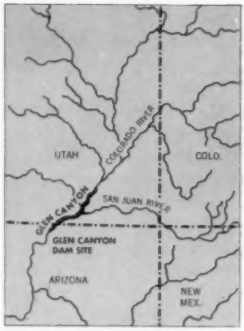
Scale of maps for Glen Canyon

Reservoir: 1″ equals 400′, 10′ contours

Dam site: 1″ equals 50′, 2′ contours

Areas adjacent to dam site: 1″ equals 200′, 5′ contours

During the past 34 years, Fairchild crews have flown similar mapping assignments all over the free world. Results produced from this experience have led thousands of Fairchild clients to say . . . if you want it done *fast* and *right the first time*, you can depend on Fairchild.



Site of the 700′ Glen Canyon Dam, second in height only to Hoover Dam (726′) is located 12 miles downstream from the Arizona-Utah border—370 miles upstream from Hoover Dam.

Walls of the canyon at the dam site are 650′ high with overhang in places. This necessitated flight paths parallel to the walls but offset to see under the overhangs.

FAIRCHILD AERIAL SURVEYS, INC.

Los Angeles, California: 224 East Eleventh Street • **New York, New York:** 30 Rockefeller Plaza • **Chicago, Illinois:** 111 West Washington • **Long Island City, New York:** 21-21 Forty-First Avenue • **Tallahassee, Florida:** 1514 South Monroe Street • **Boston, Massachusetts:** New England Survey Service, 255 Atlantic Avenue • **Shelton, Washington:** Box 274, Route 1 • **Houston, Texas:** 3325 Las Palmas • **Birmingham, Alabama:** 2229 First Ave. North

MAP INFORMATION

This department was inaugurated for the purpose of bringing to the attention of the members information pertaining to the availability of maps, surveys, etc., with particular emphasis on how such material can be procured. It is believed that through an interchange and dissemination of such information maximum benefits will accrue to the surveying and mapping profession.

—EDITOR

Topographic Maps

THE FOLLOWING quadrangle maps were published or became available for distribution by the U. S. Geological Survey between December 1, 1957 and February 28, 1958. The list includes newly compiled maps; revised maps on which contours and drainage usually are unchanged but the works of man are brought up to date; and series-converted maps which are 15-minute maps produced from four 7½-minute maps of the same area. The maps are new unless otherwise designated by numerical superscript.

The quadrangle name (in capital letters) is followed by the name of the county (in upper- and lower-case letters) that contains the place or feature for which the quadrangle is named.

All maps are available with or without the green overprint that indicates woodland. These maps show the shape and elevation of the land surface (represented by contour lines, printed in brown); water features (in blue); works of man, including cities, towns, and scattered habitations, schools, churches, railroads, roads and boundaries, place and feature names (in black); and woodland areas (in green). Principal roads are shown by a red overprint. In areas that have been covered by Bureau of Land Management surveys, township and section lines are shown. The State rectangular coordinate and the UTM 1,000-meter grid systems are indicated in the margins of the maps. An information folder further describing topographic maps is available on request.

Standard quadrangle maps may be obtained for 30 cents per copy. A discount of 20 percent is allowed on orders amounting to $10 or more at the retail price; a discount of 40 percent is allowed on orders amounting to $60 or more. Orders should be addressed to the U. S. Geological Survey, Washington 25, D. C., (or Denver 15, Colo., for maps of areas west of the Mississippi River).

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* Indicates 15-minute quadrangles; all others are 7½-minute quadrangles.
[1] Indicates a revised map.
[2] Indicates a series-converted map.
† Indicates availability in either a contour or a shaded-relief edition.
‡ Indicates preliminary black and white edition.

Alabama
PITTSVIEW—Russell
ST. ELMO—Mobile
TANNER WILLIAMS—Mobile

Alabama-Georgia
OMAHA—Stewart

Alaska
DIXON ENTRANCE (D-3)*—First Judicial Division
KATEEL RIVER (B-2)*—Fourth Judicial Division
KATEEL RIVER (B-3)*—Fourth Judicial Division
KOTZEBUE (A-1)*—Second Judicial Division
KOTZEBUE (A-6)*—Second Judicial Division
KOTZEBUE (D-2)*—Second Judicial Division
MELOZITNA (A-1)*—Fourth Judicial Division
NORTON BAY (B-1)*—Fourth Judicial Division
PETERSBURG (C-3)*—First Judicial Division
PORT ALEXANDER (A-1)*—First Judicial Division
RUBY (B-4)*—Fourth Judicial Division
SELAWIK (D-6)*—Second Judicial Division
SUMDUM (B-4)*—First Judicial Division
TANACROSS (D-6)*—Fourth Judicial Division

Arizona
CALDERWOOD BUTTE—Maricopa
LOST SPRING MTN.*—Mohave
‡SONSALA BUTTE 1 NW—Apache
‡SONSALA BUTTE 1 SW—Apache
‡SONSALA BUTTE 2 NE—Apache
‡SONSALA BUTTE 2 NW—Apache
‡SONSALA BUTTE 2 SE—Apache

‡SONSALA BUTTE 2 SW—Apache
‡SONSALA BUTTE 4 NE—Apache
‡SONSALA BUTTE 4 NW—Apache
‡SONSALA BUTTE 4 SW—Apache
WHITE TANK MTS. NE—Maricopa
‡ZITH-TUSAYAN BUTTE 1 NW—Apache
‡ZITH-TUSAYAN BUTTE 1 SW—Apache

Arizona-New Mexico

‡SONSALA BUTTE 1 NE—Apache
‡SONSALA BUTTE 1 SE—Apache
‡SONSALA BUTTE 4 SE—Apache
‡ZITH-TUSAYAN BUTTE 1 NE—Apache
‡ZITH-TUSAYAN BUTTE 1 SE—Apache

Arkansas

AUGUSTA*—Woodruff
DECKERVILLE*—Poinsett
GREGORY*—Woodruff

California

ALAMORIO—Imperial
BARSTOW*—San Bernardino
BURREL[1]—Fresno
CALIPATRIA SW—Imperial
CARMEL VALLEY—Monterey
CASTLE BUTTE*[1]—Kern
CHEWS RIDGE—Monterey
CHOUNET RANCH—Fresno
COPPER MTN.—Stanislaus
CRESCENT CITY—Del Norte
DAGGETT*—San Bernardino
DOS PALOS—Merced
GLOBE—Tulare
GONZALES—Monterey
GREENFIELD—Monterey
GUIJARRAL HILLS—Fresno
HARVEY MTN.*—Lassen
HAYDEN HILL*—Lassen
IRON MOUNTAINS*—San Bernardino
JAMUL*[1]—San Diego
MENDENHALL SPRINGS—Alameda
MENDOTA DAM—Madera
MESCAL CREEK—Los Angeles
SAN ARDO*[1]—Monterey
SAN FRANCISCO NORTH[1]—San Francisco
SAN FRANCISCO SOUTH[1]—San Francisco
SEVENTEEN PALMS—San Diego
SUPERSTITION MTN.—Imperial
VANGUARD—Kings
WESTMORELAND—Imperial
WILCOX RIDGE—Stanislaus

California-Nevada

CRESCENT PEAK*—Clark
TRUCKEE*—Nevada

California-Oregon

SMITH RIVER—Del Norte

Colorado

ANTERO RESERVOIR NE—Park
FAIRPLAY EAST—Park
HIGHLANDS RANCH[1]—Douglas
LAFAYETTE[1]—Boulder
McCURDY MOUNTAIN—Park
MT. HARVARD*—Chaffee
PINEY CREEK—Arapahoe
RADIAL MOUNTAIN—Grand
TARRYALL—Park

Connecticut

ROXBURY[1]—Litchfield

Connecticut-Rhode Island

EAST KILLINGLY[1]—Windham

Delaware

LITTLE CREEK[1]—Kent

Delaware-New Jersey

BOMBAY HOOK[1]—Kent

Georgia

ALBANY WEST—Dougherty
BACONTON*—Mitchell
CAIRO*—Grady
COCHRAN*—Bleckley
JEFFERSONVILLE*—Twiggs
MACON WEST—Bibb
NEWTON*—Baker
SASSER*—Terrell
SYLVESTER*—Worth

Idaho

BIG HILL*—Owyhee
CRATER RINGS SE—Elmore

Illinois

ALEDO EAST—Mercer
ALEDO WEST—Mercer
BUFFALO PRAIRIE—Rock Island
FITHIAN*[1]—Vermilion
GIBSON CITY*[1]—Ford
NEW WINDSOR—Mercer
ORION—Henry
PAXTON*—Ford
POTOMAC*[1]—Vermilion
REYNOLDS—Rock Island

Illinois-Iowa

ANDALUSIA—Rock Island
JOY—Mercer
MONTPELIER—Muscatine

Indiana

CATARACT—Owen
LIGONIER—Noble
LORANE—Whitley
RAYS CROSSING—Shelby
RUSK—Martin
SPENCER—Owen
SULLIVAN[1]—Sullivan

Iowa

AUDUBON*—Audubon
DAVENPORT WEST—Scott
DE WITT—Clinton
DIXON—Scott
DONAHUE—Scott
ELDRIDGE—Scott
GRAND MOUND—Clinton
MALONE—Clinton
McCAUSLAND—Scott
WALCOTT—Muscatine
WHEATLAND—Clinton

Iowa-Nebraska

COUNCIL BLUFFS NORTH—Pottawattamie
COUNCIL BLUFFS SOUTH—Pottawattamie
PACIFIC JUNCTION—Mills

Kansas

OLATHE[1]—Johnson

Louisiana

ASHLAND*[1]—Nachitoches
GOLDONNA*[1]—Natchitoches
GRAND CANE*[1]—De Soto
POINTE A La HACHE*[1]—Plaquemines
RINGGOLD*[1]—Bienville

Louisiana-Texas

LOGANSPORT*[1]—De Soto

Maine

ANSON*—Somerset
YORK BEACH*[1]—York

Maine-New Hampshire

DOVER EAST[1]—Stratford
KITTERY[1]—York

Maryland

BRANDYWINE[1]—Prince Georges

Massachusetts

GOSHEN[1]—Hampshire
LEXINGTON[1]—Middlesex

Massachusetts-New Hampshire

LAWRENCE[1]—Essex

Michigan

BAR LAKE*—Manistee
FRANKFORT*—Benzie
HOUGHTON LAKE*—Roscommon
KALKASKA*—Kalkaska
LAKE CITY*—Missaukee
SAGOLA*[2]—Dickinson
WHITE PINE*—Ontonagon
WHITE PINE[1]—Ontonagon

Minnesota

BARNUM—Carlton
CHAD LAKE—St. Louis
CRAB LAKE—St. Louis
EAGLES NEST—St. Louis
FLORIAN*—Marshall
SOUDAN—St. Louis
SPLIT ROCK POINT*[2]—Lake

Minnesota-Wisconsin

LaCRESCENT*—Houston

Mississippi

GREENWOOD*—Carroll
PHILIPP*—Tallahatchie

Montana

ACTON—Yellowstone
BILLINGS EAST—Yellowstone
BOYD—Yellowstone
FISHTAIL—Stillwater
FROMBERG—Carbon
GARDINER*—Park
HICKSON RANCH—Yellowstone
LAUREL—Yellowstone
LLOYD*—Blaine
MOSSMAIN—Yellowstone
PARK CITY—Stillwater
RAPIDS—Stillwater
RATTLESNAKE BUTTE—Yellowstone
SHANE RIDGE—Stillwater

Nebraska

BARTLEY—Redwillow
CAMBRIDGE—Furnas
CURTIS—Frontier
IRVINGTON—Douglas
MEDICINE CREEK DAM—Frontier
MURRAY—Cass
RALSTON—Douglas
STOCKVILLE SE—Frontier

Nebraska-Iowa

PLATTSMOUTH—Cass

Nevada

AUSTIN*—Lander
BARTINE RANCH*—Eureka
BULL RUN*—Elko
HALL CREEK*—Lander
IMLAY*—Pershing
MILLETT RANCH*—Nye
WHISTLER MTN.*—Eureka
WILD HORSE*—Elko

New Hampshire

NEWMARKET[1]—Rockingham
SUNAPEE*—Sullivan

New Jersey

CEDARVILLE—Cumberland
FIVE POINTS—Atlantic
FORKED RIVER—Ocean
PATTERSON[1]—Passaic

New Jersey-Delaware

BEN DAVIS POINT[1]—Cumberland

New Jersey-New York

ELIZABETH—Union

New Mexico

ESPANOLA*[2]—Rio Arriba
HAMMOND RANCH*—Curry
MELROSE*—Curry
PORTAIR*—Roosevelt
PORTALES*—Roosevelt

New Mexico-Texas

ARCH*—Roosevelt
CLOVIS*—Curry
PLEASANT HILL*—Curry

New York

APALACHIN—Tioga
AU SABLE FORKS*—Essex
CENTRAL SQUARE—Oswego
FLUSHING—Queens
GLENS FALLS*—Warren
GREENPORT—Suffolk
HARRISBURG*—Warren
LAKE LUZERNE*—Warren
MAINE—Broome
NAPANOCH[1]—Ulster
NAPEAGUE BEACH—Suffolk
NEW HAVEN—Oswego
OHIO*—Herkimer
PINE BUSH[1]—Orange
SANTONONI*—Essex
SOUTHAMPTON—Suffolk
SOUTHOLD—Suffolk
SYLVAN BEACH[1]—Oneida
WEST CANADA LAKES*—Hamilton

New York-Connecticut

MAMARONECK[1]—Westchester

New York-Vermont

WILLSBORO*[1]—Essex

North Dakota

BLACKWATER LAKE—McLean
BLACKWATER LAKE NW—McLean
EMMET—McLean
EMMET NE—McLean
ROSEGLEN—McLean

Oregon

BALLSTON—Polk
BATTLE AX*—Marion
DIAMOND LAKE*—Douglas
DUNDEE—Yamhill
FISH CREEK MTN.*—Clackamas
LOWELL*—Lane
MILL CITY*—Lane
MT. WILSON*—Wasco
QUARTZVILLE*—Linn
TOKETEE FALLS*—Douglas

Pennsylvania

ANDERSONBURG—Perry
CARLISLE—Cumberland
DICKINSON—Cumberland
DILLSBURG—York
DONEGAL*[2]—Westmoreland
DUNCANNON—Perry
ICKESBURG—Perry
LANCASTER—Lancaster
LANDISBURG—Perry
MECHANICSBURG—Cumberland
MOUNT HOLLY SPRINGS—Cumberland
NEWPORT—Perry
NEWVILLE—Cumberland
PINE GROVE*[2]—Schuylkill
PLAINFIELD—Cumberland
POTTSTOWN—Montgomery
SHERMANS DALE—Perry
SPRUCE HILL—Juniata
WALNUT BOTTOM—Cumberland
WERTZVILLE—Cumberland

Pennsylvania-New Jersey

STROUDSBURG[1]—Monroe

Puerto Rico

ROSARIO[1]—San German

South Dakota

BLACK HORSE—Corson
HITCHCOCK SE—Beadle
MISCOL—Corson
PREACHER SPRING—Pennington

Texas

ABERNATHY*—Hale
ANTON*—Hockley
AQUILLA—Hill
CHINA SPRINGS—McLennan
CRAWFORD—McLennan
ELK—McLennan
‡FLORESVILLE*—Wilson
GHOLSON—McLennan
LUBBOCK EAST—Lubbock
LUBBOCK WEST—Lubbock
MALONE—Hill
MART—McLennan
NEW HOME—Lynn
OTTO—Falls
PEORIA—Hill
PULLMAN*—Potter
RICHMOND*—Fort Bend
SAN ANGELO NORTH—Tom Green
SPEEGLEVILLE—McLennan
TWIN BUTTES—Tom Green
VALLEY MILLS—Bosque

Texas-Louisiana

PATROON*[1]—Shelby
SABINE PASS*[1]—Jefferson
SABINE PASS[1]—Jefferson

Utah

GREEN RIVER*—Emery
NOTOM*—Wayne
SAN RAFAEL KNOB*—Emery
SPLIT MOUNTAIN—Uintah
TORRY*—Wayne
WILD HORSE*—Emery

Utah-Colorado

COATES CREEK*[2]—Grand

Vermont

WALLINGFORD*—Rutland

Virginia

BLACKSTONE[1]—Nottoway
DARVILLS[1]—Dinwiddie
FAIRFAX[1]—Fairfax
GLOUCESTER[1]—Gloucester
GRESSITT[1]—King and Queen
HERNDON[1]—Fairfax
NORGE[1]—James City
TOANO—James City
WILLIAMSBURG[1]—James City

Virginia-North Carolina

SUFFOLK*—Nansemond

Washington

CARLSBORG—Clallam
EPHRATA—Grant
GLOYD—Grant
MINERAL*—Lewis
MORSE CREEK—Clallam
SEQUIM—Clallam
SIELER—Grant
SOAP LAKE—Grant
STRATFORD—Grant
UTSALADY—Island
WILSON CREEK SW—Grant

Washington-Oregon

BRIDAL VEIL*—Multnomah
CAMAS*—Clark

West Virginia

MIDDLEWAY[1]—Jefferson

Wisconsin

OCONTO FALLS*—Oconto
REEDSBURG*—Sauk
UPSON—Iron

Wisconsin-Minnesota

MILLTOWN*—Polk
WEBSTER*—Burnett

Wyoming

DEAD INDIAN PEAK*—Park

In addition to the standard series of quadrangle maps, small-scale (1:250,000) maps of areas in the United States and Territories are being published and distributed. They may be purchased from the Geological Survey for 50 cents per copy. An index to the series is available on request.

Alaska

FAIRBANKS†
KANTISHNA RIVER†
RUBY†

New Mexico-Texas

CLOVIS
TUCUMCARI

Texas

ABILENE
AMARILLO
BIG SPRING
DALLAS
FORT STOCKTON
LUBBOCK
PLAINVIEW
SAN ANGELO
SEQUIN
SONORA

Texas-Oklahoma

SHERMAN
WICHITA FALLS

Special metropolitan-area and vicinity maps of major United States cities are being published and distributed by the Geological Survey. These maps are prepared from standard 7½-minute maps at the scale of 1:24,000. Vicinity maps may be purchased from the Geological Survey for the prices indicated below.

ATLANTA AND VICINITY (50 by 56 inches) $1.50.
HOUSTON AND VICINITY (50 by 66 inches) $1.50.

State maps are also being published and distributed. These maps may be purchased from the Geological Survey for the prices indicated below.

#NORTH CAROLINA (base map). (66 by 28½ inches) 1:500,000 scale. $1.
NORTH CAROLINA (topographic). (29 by 67 inches) 1:500,000 scale. $2.
#IOWA (base) (16½ by 24 inches) 1:1,000,000 scale. 20¢.

# Indicates the map does not show contours.

Lake Survey Charts

PUBLICATION of new editions of the following Lake Survey Charts has been announced by the United States Lake Survey of the Corps of Engineers, U. S. Army. Copies of these charts may be obtained from the U. S. Lake Survey, 630 Federal Building, Detroit 26, Mich., at 75 cents per copy. Payment is required in advance by P. O. money order or draft, payable to the Treasurer of the United States. A catalog showing the areas described below is available free upon request.

62.—St. Marys River. Lake Munuscong to Saulte Ste. Marie, including Lake George, at 1:40,000 scale. (October 1957)
66.—Inland Route, Mich., Cheboygan, Mich., to Little Traverse Bay, at 1:40,000 scale. Inset: Cheboygan Harbor, Mich., at 1:15,000 scale. (January 1958)
98.—Coast Chart. Isle Royale, Mich., including Thunder Bay, Ont., and coast from Grand Portage Bay, Minn., to Shesheeb Point, Ont., at 1:120,000 scale. (January 1958)
524.—Saginaw River, Michigan. Entire river and entrance channel to Saginaw Bay at 1:20,000 scale. (January 1958)
601.—Les Cheneaux Islands, Michigan, at 1:20,000 scale. (January 1958)
776.—Manistee, Mich., and Manistee Lake at 1:10,000 scale. (January 1958)
981.—Isle Royale, Michigan, at 1:40,000 scale. (October 1957)

Public Land Survey Plats

THE FOLLOWING plats of public land surveys and resurveys were completed and accepted by the Bureau of Land Management between December 1, 1957, and February 28, 1958. The class or purpose of the survey is indicated. Copies of plats may be secured from the Bureau offices in the States or from the Director, Bureau of Land Management, Department of the Interior, Washington 25, D. C.

Alaska

U. S. Survey No. 3398—Wrangell Small Tracts
U. S. Survey No. 3403—Wrangell Small Tracts
U. S. Survey No. 2538 B—Townsite of Kodiak, East Addition Extension

Arizona—Gila and Salt River Meridian

T. 42 N., R. 5 E.—Survey, part of subdivision
T. 41 N., R. 6 E.—Survey, N. and E. boundaries
T. 42 N., R. 6 E.—Survey, part of subdivision
T. 29 N., R. 18 W.—Survey, parts of N. and W. boundaries
T. 30 N., R. 19 W.—Survey, part of subdivision
T. 29 N., R. 20 W.—Survey, N., E., and W. boundaries
T. 30 N., R. 20 W.—Survey, part of subdivision
T. 30 N., R. 21 W.—Survey, N., S., and W. boundaries
T. 8 S., R. 26 E.—Dependent resurvey of boundaries
T. 7 S., R. 27 E.—Dependent resurvey, part of subdivision
T. 8 S., R. 27 E.—Dependent resurvey, part of subdivision

California—San Bernardino Meridian

T. 17 N., R. 1 E.—Skeleton survey
T. 17 N., R. 2 E.—Skeleton survey
T. 18 N., R. 1 E.—Skeleton survey
T. 18 N., R. 2 E.—Skeleton survey
T. 18 N., R. 3 E.—Skeleton survey
T. 18 N., R. 4 E.—Skeleton survey
T. 18½ N., R. 1 E.—Skeleton survey
T. 19 N., R. 1 E.—Skeleton survey
T. 19 N., R. 2 E.—Skeleton survey
T. 19 N., R. 3 E.—Skeleton survey
T. 19 N., R. 4 E.—Skeleton survey
T. 20 N., R. 1 E.—Skeleton survey
T. 20 N., R. 2 E.—Skeleton survey
T. 20 N., R. 3 E.—Skeleton survey

Idaho—Boise Meridian

T. 14 S., R. 33 E.—Dependent resurvey

Kansas—Sixth Principal Meridian

T. 1 S., R. 19 W.—Dependent resurvey-part
T. 1 S., R. 20 W.—Dependent resurvey-part
T. 1 S., R. 21 W.—Dependent resurvey-part
T. 2 S., R. 20 W.—Dependent resurvey-part
T. 2 S., R. 21 W.—Dependent resurvey-part
T. 2 S., R. 22 W.—Dependent resurvey-part
T. 3 S., R. 23 W.—Dependent resurvey-part
T. 3 S., R. 24 W.—Dependent resurvey-part
T. 3 S., R. 25 W.—Dependent resurvey-part

Michigan—Michigan Meridian

T. 15 N., R. 8 W.—Survey of island-sec. 10

Nebraska—Sixth Principal Meridian

T. 29 N., R. 10 W.—Dependent resurvey
T. 30 N., R. 10 W.—Dependent resurvey
T. 18 N., R. 16 W.—Dependent resurvey-part
T. 19 N., R. 16 W.—Dependent resurvey-part
T. 20 N., R. 16 W.—Dependent resurvey-part
T. 21 N., R. 19 W.—Dependent resurvey-part
T. 21 N., R. 18 W.—Dependent resurvey-part

New Mexico—New Mexico Principal Meridian

T. 7 N., R. 12 W.—Dependent resurvey
T. 8 N., R. 12 W.—Dependent resurvey

Oregon—Willamette Meridian

T. 2 S., R. 5 W.—Dependent resurvey-part
T. 16 S., R. 6 W.—Dependent resurvey-part
T. 23 S., R. 7 W.—Dependent resurvey-part
T. 21 S., R. 11 W.—Dependent resurvey-part
T. 33 S., R. 1 E.—Dependent resurvey-part
T. 15 S., R. 23 E.—Dependent resurvey-part

South Dakota—Black Hills Meridian

T. 3 S., R. 18 E.—Dependent resurvey
T. 4 S., R. 18 E.—Dependent resurvey

Utah—Salt Lake Meridian

T. 28 S., R. 9 E.—Dependent resurvey-part
T. 10 S., R. 19 E.—Resurvey and extension survey

Wyoming—Sixth Principal Meridian

T. 24 N., R. 62 W.—Dependent resurvey
T. 24 N., R. 63 W.—Dependent resurvey
T. 25 N., R. 63 W.—Dependent resurvey
T. 24 N., R. 64 W.—Dependent resurvey
T. 48 N., R. 75 W.—Dependent resurvey
T. 43 N., R. 76 W.—Dependent resurvey
T. 44 N., R. 76 W.—Dependent resurvey
T. 43 N., R. 77 W.—Dependent resurvey
T. 41 N., R. 116 W.—Dependent resurvey

Coast and Geodetic Survey Charts

The following new or basically changed nautical and aeronautical charts were issued by the Coast and Geodetic Survey during the first quarter of 1958. Copies may be secured from Bureau offices and authorized agents in the United States and possessions, or from the Director, Coast and Geodetic Survey, Washington 25, D. C. Remittances covering cost should be made payable to C&GS, Department of Commerce. Complete catalogs of both nautical and aeronautical charts are issued free upon request.

Nautical

296—Delaware River, Philadelphia to Trenton. Harbor chart showing river channels, including those recently widened and realigned; at scale of 1:20,000 (February 1958) 75 cents.

348—Woods Hole, Mass. Completely reconstructed including new detail; at scale of 1:5,000 (January 1958) 75 cents.

6122—Nehalem River, Oreg. Harbor chart of river and channel from entrance to Nehalem, showing recent shifting and shoaling of channel below Wheeler; at scale of 1:20,000 (January 1958) 25 cents.

8834—Port Heiden, Alaska Peninsula. Preliminary edition of new coast chart, based on 1957 surveys in Bristol Bay; at scale of 1:80,000 (February 1958) 50 cents.

8860—Unimak and Akutan Passes and Approaches, Alaska. General chart of easterly portion of Aleutian Islands, including plan of the previously unsurveyed Amak Island; at scale of 1:300,000, with Amak Island plan at 1:80,000 (March 1958) $1.00.

9129—Temnak Bay, Attu Island, Aleutian Islands. Completely reconstructed harbor chart based on modern surveys; at scale of 1:20,000 (January 1958) 75 cents.

Aeronautical

Kansas City. Sectional chart on completely reconstructed base; at scale of 1:500,000 (January 1958) 25 cents.

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Comment and Discussion

The pages of SURVEYING AND MAPPING are open to a free and temperate discussion of all matters pertaining to the interests of the CONGRESS. It is the purpose of this Department to encourage comments and published material or the presentation of new ideas in an informal way.
—EDITOR

MORE ABOUT FINDING THE RADIUS OF AN EXISTING HORIZONTAL CIRCULAR CURVE

KENNETH A. MACFAYDEN*—SURVEYING AND MAPPING arrived today, and as usual all work stopped until I had a good look at it.

In "Comment and Discussion," under the heading "Finding the Radius of an Existing Horizontal Circular Curve," an approximate method is given. There is an exact method so simple that a "short cut" is hardly worth while. Somewhere in my geometry course, I had to prove that the perpendicular bisector of a chord divided the diameter into two segments whose product is equal to the product of the two half-chords. (*See* Figure 1.)

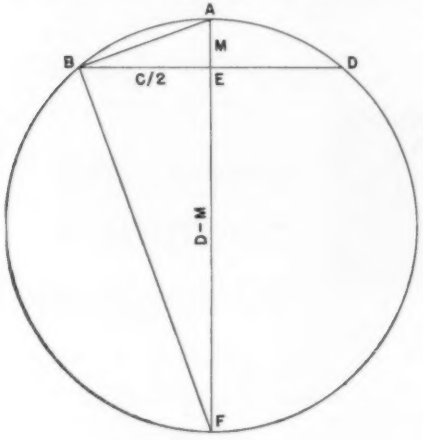

FIGURE 1.

In the field, the mathematics is simplified by making M an even-foot distance, or else by making $C/2$ a multiple of ten feet.

If you are really lazy, you can make M equal to one foot. The product of the half-chords is then one foot less than the diameter of the curve. (Don't forget to divide it by two for the radius!)

$ABD + DBF = 90°$, because the arc subtended $= 180°$.

$BFA + DBF = 90°$, by construction.

$$ABD = BFA$$

$$\tan ABD = \tan BFA$$

$$\frac{M}{C/2} = \frac{C/2}{(D-M)}$$

$$(D-M) = \frac{(C/2)^2}{M}$$

$$(D-M) + M = D = 2R$$

* Chairman, Land Surveyors Division, New Jersey Society of Professional Engineers, 51 Pill Hill Road, Bernardsville, N. J.

Another Summer Surveying Camp Folds Up

In a release from the Public Relations office of Case Institute of Technology, dated May 2, 1958, and dealing with proposed changes in the civil engineering curriculum at that institution, we find the following:

"The traditional two-week summer surveying camp for freshmen and sophomores has been dropped, and surveying will be taught as a single, one-semester course during the sophomore year."

News of Related Organizations

ACSM to be Represented at Ninth International Congress of Surveyors

ACSM's President W. B. Williams of Grand Rapids, Michigan, and Vice President George C. Bestor of Carmel, California, are completing plans to attend and represent the American Congress on Surveying and Mapping at the Ninth International Congress of Surveyors sponsored by the International Federation of Surveyors.

The Ninth International Congress of Surveyors, organized by the International Federation of Surveyors (IFS) or Fédération Internationale des Géomètres (FIG) will be held from August 28 to September 4, 1958, in Scheveningen and Delft, Netherlands.

The principal aims of the IFS are as follows:

To group the national associations or organizations of surveyors of all countries with the object of interchanging views on matters of general interest to the profession.

To organize liaison between the various affiliated associations.

To make known information on the social conditions prevailing among professional surveyors in individual countries so that each may take advantage of the improvements attained.

To encourage, subsidize, and disseminate the results of professional research, and discoveries useful to surveyors, in the scientific, technical, legal, economic, and social spheres.

To coordinate professional training in accordance with new methods.

To foster relations with the appropriate authorities and the exchange of surveying personnel between different countries.

The Federation abstains from any interference in questions of a political or religious nature and from intervening in racial disputes.

The Federation realizes the above-mentioned aims by organizing:

International Congresses,

Meetings of committees,

Periodical meetings of delegates of the national associations constituting the Permanent Committee of the Federation, and

Lectures, exhibitions, and experiments to demonstrate methods or instruments.

The scientific part of the Congress consists of the work of the seven technical Commissions, respectively covering the following fields: Technical Dictionary; Cadastre and Rural Reallotment; Instruments and Methods, Photogrammetry, and Cartography; Town Planning and Urban Reallotment; Junior Surveyors; Professional Activities and Emoluments; and Professional Training.

Beside the scientific part of the Congress, an entertainment program has been planned which will enable the members of the Congress to become acquainted with the Netherlands and to take up further contacts with colleagues from other countries in an informal atmosphere.

Accomodations for those attending the Congress will be provided mainly at the seaside resort of Scheveningen. The Commission meetings will be held in one of the buildings of the Technical University of Delft. In the same building there will be an Exhibition of surveying instruments; drawing materials; reproduction, computing, and administration machines; etc.

The languages at the Congress will be French, English, and German.

The members of Associations affiliated with IFS may obtain the provisional program of the Congress at the secretariats of their Associations. All others interested may receive the provisional program by applying directly to:

Congres F.I.G., Kanaalweg 4, Delft, Netherlands.

ACSM members planning to attend this meeting, which schedules during the Brussels World's Fair, are advised to make their plans and reservations as early as possible, as travel and hotel accommodations are becoming heavily booked.

F.I.G. deals with practically the same matters covered by the American Congress on Surveying and Mapping as evidenced in the scope

of ACSM's Journal—SURVEYING AND MAPPING. With the Association Internationale de Geodesie (AIG) and the International Society of Photogrammetry (ISP) the F.I.G. (or I.F.S.) is one of the three great international nongovernmental organizations in the field of earth-measuring sciences and practice.

AIG devotes itself mainly to determination of the figure of the earth by triangulation, trilateration, and leveling, supported by and connected with astronomical geodesy and gravimetry.

ISP concerns itself with the development of photogrammetry, its many physical, constructional and mathematical aspects, and its fields of application in a narrower sense. Collaborators of the AIG and the ISP are, in many cases, specialists.

The IFS, however, unites the large group of geodetic engineers and surveyors working in Cadastral and Technical Survey Departments, Institutions, or Private Enterprises. The scope of the IFS has a small field in common with the AIG, while the overlap with the ISP is somewhat larger. However, the publications and discussions of the IFS always have a character of their own, which is determined by the whole complex of work done by the above-mentioned services, institutions, and private enterprises.

In this field of work, great scientific and practical advances have been made in recent years. However, this progress is often not passed on from country to country because each nation concentrates on its own internal problems and methods; so, apart from stimulating progress, the IFS wants to propagate it and make it known.

A similarity in scope and objectives between ACSM and IFS is quite apparent.

Eighth Consultation on Cartography Pan American Institute of Geodesy and History

The Eighth Consultation of the Commission on Cartography of the Pan American Institute of Geodesy and History was held in Havana, Cuba, February 12–22, 1958. Representatives from twenty-two of the American Republics participated in this consultation, either as delegates, advisers, or observers. It was unfortunate that a few of the Republics had not had sufficient time after receiving the announcement of the consultation to make the necessary arrangements for a delegation. However, the general response was excellent and there were more than 200 people in attendance.

The technical work of the Commission on Cartography is carried on in eight committees. These are Geodesy, Gravity and Geomagnetism, Seismology, Topographic Mapping and Photogrammetry, Aeronautical Charts, Tides, Special Charts, and Urban Surveys. All of these committees held separate meetings at which reports of the progress of the work of that particular committee in each country were received. Objectives and resolutions for continuing existing programs or initiating new projects within the Republics were prepared and forwarded to the Commission for approval and adoption at the final plenary session of the Consultation.

One of the outstanding reports received related to the progress of mapping in the American Republics. The large-scale topographic mapping programs in Cuba and El Salvador are nearing completion and complete sets of topographic maps for these two Republics will be available by the end of this calendar year.

The hospitality of the officials of the Cuban Government, providing spacious accommodations for these meetings and arranging for social functions whereby representatives from the different countries might become better acquainted, was outstanding. These consultations provide a means of maintaining international friendship and also establishing new associations, thus effecting a greater coordination of surveying and mapping efforts in the Western Hemisphere.

Wisconsin Society of Land Surveyors

Information has been received that the officers elected to serve the Wisconsin Society of Land Surveyors during the year 1958 are as follows:

President—George E. Phillips.

Vice President—Thomas W. Pipps.

Secretary-Treasurer—Robert L. Smith, 6707 32nd Avenue, Kenosha, Wisconsin.

Illinois Land Surveyors Conference

Land surveyors from all parts of the State of Illinois met on the campus of the University of Illinois for a three-day conference March 10–12, 1958. Over 100 surveyors and others interested in the field heard stimulating discussions on such topics as "Standards and Ethics," "Platting and Planning Regulations by State, County, and Municipalities," "The Land Surveyor Registration Law," "Surveyor's Business Problems," "Subdivisions and Land Planning," and various other topics.

The conferees were privileged to hear informed and able speakers from surveying businesses, public utilities, State and Federal organizations, etc. One of the more distinguished speakers was Willfred B. Williams, president of ACSM for 1958.

On the final afternoon a business session was held, and, after much debate, the Illinois group voted to form a temporary organization until affiliation could be studied further. Committees were appointed to plan the 1959 as well as the 1960 conference that will play host to other State groups in the Great Lakes section.

Proceedings of the conference are being prepared and will be available this summer.

—WINFIELD H. ELDRIDGE

Kansas Society of Land Surveyors

The board of direction of the newly formed Kansas Society of Land Surveyors held its first quarterly meeting in December 1957 and its second meeting on March 1, 1958.

At these two meetings applications of three local groups to become chapters of KSOLS were approved. These include: the Kansas City Chapter—Phil Kline, Temporary President; the Salina Chapter—Hugh Hull, President; and the Topeka Chapter—Charles N. Pfarr, President.

Officers of the Society for 1958 are as follows:

Paul H. Sweeney, *President*
James L. Bell, *Vice President*
Wendell C. Wyatt, *Sec.-Treas.*
L. Dean Strowig, *Editor*

Vice President Bell was appointed official delegate of KSOLS to ACSM's Eighteenth Annual Meeting in Washington.

—WENDELL C. WYATT
Secretary-Treasurer

Redwood Region Organizations Celebrate Engineers' Week

National Engineers' Week, proclaimed by President Eisenhower, was observed in Santa Rosa, Calif., on February 21, 1958, with a combined meeting of the three local engineer and surveyor organizations, namely: The Sonoma, Lake, and Mendocino Counties Civil Engineers' and Land Surveyors' Association; The Redwood Region Branch of the American Society of Civil Engineers; and The Redwood Chapter, California Society of Professional Engineers.

Also invited to the dinner and program were the members of the Santa Rosa College Engineers' Club and their professors, all Redwood Region county surveyors and city engineers, and the officers of the Northern California Section, ACSM.

About one hundred persons attended and heard Farrell McGhie, Ph.D., Associate Professor of Engineering, Stanford University, speak on "The Future of Engineering." Doctor McGhie directed his remarks primarily toward the students and explained what might be expected in life as a result of obtaining an engineering degree.

—PAUL J. DOWLING
Editor, N.C.S., ACSM

San Joaquin Valley Surveyors Conference

The able leadership of Professor Edward F. Kulhan was largely responsible for a very successful Surveyors Conference held at Fresno State College, Fresno, Calif., April 3–4, 1958, at which there was a registered attendance of 187, despite floods which prevented some of the speakers from keeping their appointments.

The two-day program afforded a well-rounded presentation of papers by individual speakers, panel discussions, and exhibits. A tour of the new Engineering Building now nearing completion of the campus of Fresno State College was conducted by members of the Fresno State College student Engineers Club. Exhibits were open from nine to five both days.

Indiana Society of Professional Land Surveyors

About 100 Indiana land surveyors attended the sixth annual Land Surveyor's Conference held on the Purdue campus, January 17–18, 1958. Many interesting topics were discussed and several far-reaching committee reports and proposals were adopted by the Indiana Society of Professional Land Surveyors. These include the adoption of a Schedule of Minimum Surveying Fees, a Set of Technical Standards for Land Surveying, and a Code of Ethics. Other important committee reports included those from the Examinations Committee and the Historical Preservation Committee.

At the annual business meeting of the Indiana Society of Professional Land Surveyors, the following officers were elected for the year 1958:

President—George A. Crowder, Columbus

Vice President—C. B. Wood, Angola

Secretary-Treasurer—Owen C. Smith, Fort Wayne

Executive Secretary (appointed)—Kenneth S. Curtis, Lafayette

Directors—1958–59–60
Frank White, Spencer
Arthur Buerkle, Lafayette

1958–59
Robert Krull, Hobart
Richard Long, Indianapolis

1958
Samuel Brownsten, Crown Point
Bert McClellan, South Bend

McKnew Named Executive Vice President of National Geographic Society

The Evening Star, Washington, D. C., April 26, 1958, carried the announcement that Dr. Thomas W. McKnew, who has been Vice President and Secretary of the National Geographic Society since 1954, has now been named Executive Vice President of that organization. It was also stated that Dr. McKnew will continue as Secretary of the Society.

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CONGRESS NEWS

ACSM Western Regional Conference

Announcement was made in SURVEYING AND MAPPING, January–March 1958, Vol. XVIII, No. 1, page 128; that a regional meeting was planned for October 10–11, 1958, to be held at the County Fairgrounds Auditorium, Monterey, California. It now appears that there will also be an evening session on October 9th.

The latest advices from General Chairman George C. Bestor, Vice President of ACSM, and Prof. C. J. Aggeler, Chairman of the Program Committee for the conference, show that plans are well advanced for what bids fair to be a very fine series of meetings.

Professor Aggeler writes: "Our general theme will be 'Accuracy and Economy.' Various types of modern and conventional equipment will be used to make demonstration measurements of varying degrees of accuracy. Equipment and methods will be discussed from the standpoint of meeting accuracy requirements with the greatest economy, in various types of surveys. Mapmaking with modern equipment and methods, to meet higher accuracy requirements at lower cost, will be discussed. Also, modern methods and equipment for greater accuracy and economy in computations will be under discussion."

The time schedule and topics for discussion are tentatively set as follows:

Thursday, October 9th.

5:00 p.m.—Registration.

8:00 p.m.—Night measurements with Geodimeter, Tellurometer, and optical instruments.

Friday, October 10th.

8:30–9:30 a.m.—Registration and Exhibits.

9:30–9:40 a.m.—Our theme—Accuracy and Economy.

9:50–10:30 a.m.—Modern Methods in Mapmaking.

10:30–12:00 a.m.—Panel discussion of A.S.C.E. Task Committee Report on Status of Surveying.

12:00–3:00 p.m.—Exhibits, Lunch, Movies on Tellurometer and Geodimeter, and Demonstration of Linear Measurements.

3:00–5:00 p.m.—Horizontal Control Surveys. (Panel)

7:30 p.m.—Dinner Dance.

Saturday, October 11th.

8:30–9:30 a.m.—Exhibits.

9:30–11:00 a.m.—Modern Methods in Land Surveying. (Panel)

11:30 a.m.–1:00 p.m.—Exhibits, Demonstrations, and Lunch.

1:00–2:00 p.m.—Report on Demonstration Measurements.

2:00–3:00 p.m.—Modern Methods and Equipment for Computations.

3:00–4:30 p.m.—Vertical Control Surveys. (Panel)

In addition to the dinner dance, Friday evening, the ladies will be the guests of the Monterey Peninsula Convention Bureau on an all-day tour of the historic buildings of Monterey, the 17-Mile Drive through Del Monte Forest, lunch at Del Monte Lodge in Pebble Beach, Carmel Mission, and a chance to visit the Carmel shops. A charge of $2.50 will be made for the luncheon at Del Monte Lodge.

While ACSM members from Denver on west will be circularized concerning these meetings, any others who may want to receive further notices, registration blanks, or more information should write to Wm. A. White, Room 811, 1107 Ninth St., Sacramento 14, Calif.

The reader is referred to page 128 of the January–March 1958 issue of SURVEYING AND MAPPING for further information on the wonders of the Monterey Peninsula and the recreational activities that may serve to enliven an extra day or two, either before or after the formal meetings of the ACSM Western Regional Conference.

Colorado Section

The Colorado Section held its first meeting of the current year at Lakewood on March 4, 1958. An estimated 80 members and guests were present.

After a short business meeting, Section Chairman Emmett J. Coon presented the guest speaker, John S. Knowles, Area Office Cadastral Engineer, Bureau of Land Management, Denver. Mr. Knowles, who has been with the Bureau of Land Management since 1912, presented a broad history of the land office from colonial times to the present. He discussed the important decisions that have been made and the men responsible for the development of our present day land system.

After a short break for coffee and doughnuts, the program was concluded with the showing of a film entitled "Property Lines," from the University of California Film Library.

—JOHN R. CLEMENS
Section Editor

North Carolina Section

The newest local unit of ACSM, the North Carolina Section, held its organization meeting at Winston-Salem, N.C., on January 9, 1958. Chairman pro tem Edgar H. Kimmons presided.

Results of the letter ballot for 1958 officers, announced at the meeting, were as follows:

Benjamin E. Kirkman, *Chairman*
Robert P. Guarino, *1st Vice-Chairman*
Mack M. Lewis, *2nd Vice-Chairman*
W. Thompson Cox, *Secretary*
Grady S. Harrell, *Treasurer*

The Section approved and adopted a constitution and appointed Edgar H. Timmons as registered agent of the corporation as provided by the constitution.

Committees were appointed to work jointly with functional sections of the Professional Engineers of North Carolina on (1) uniform map laws (2) technical standards for property surveys and maps, and (3) a minimum fees schedule.

—W. THOMPSON COX
Section Secretary

Northern California Section

In an effort to determine the sentiments of the membership of the Northern California Section with respect to the interim report of the ASCE Task Committee on the Status of Surveying and Mapping, the Section devoted its January meeting to a discussion of the question: "Should Separate Licensing of Surveyors Be Abolished in California?" The meeting, held in Marysville on January 17, 1958, was conducted as a panel discussion by several prominent Northern California civil engineers and land surveyors, followed by open discussion from the audience.

The speakers were Bernhardt Berndtson, County Surveyor, Sutter County; A. L. Hawkins, Advance Planning Engineer, State Division of Highways; Harold Musser, Land Surveyor of the firm of de St. Maurice, Helmkamp, and Musser; and William A. White of the California Council of Civil Engineers and Land Surveyors. Secretary-Treasurer of the Northern California Section, ACSM, Colin Hanforth, served as moderator.

The panel and the audience agreed, almost without exception, that:

1. Surveying is a profession.
2. Surveying is a component part of civil engineering.
3. Surveyors should be licensed as a branch of civil engineering rather than as a separate group.
4. Civil engineers should be qualified to make cadastral (land) surveys, but have no qualifications for other types of survey work, such as geodetic and geologic surveying.

The majority of those present thought it possible that the surveyor might become a civil engineer with a limited license excluding certain functions such as structural engineering. Nearly all agreed that a professional person should be responsible for construction staking.

The spirit of Jasper O'Farrell, California surveyor of the 1840's and 1850's who, at the risk of his life, gave San Francisco the widest main street in America, perhaps listened attentively on the evening of February 28, 1958, when the Northern California Section met at the City College of San Francisco and took up as a

panel subject "Property Surveys in the City of San Francisco."

The meeting, with Section Chairman C. O. Greenwood, Jr., presiding, opened with a business session which included a report by Secretary William A. White to the effect that he was making good progress in arranging a convention of surveyors of all the Western States to be held in Monterey, October 10–11, 1958.

The members of the panel included Daniel P. Coleman, *Moderator,* James E. Waite, James Brennan, Joe Smithwick, and Merritt C. Mosher.

Because Mr. Waite, regarded by many as the dean of San Francisco surveyors, had suffered a heart attack, his paper was read by Mr. Brennan. Mr. Waite presented such interesting facts as (1) street centerlines do not control the property lines nor are they parallel to them, (2) that many of the blocks are at an angle with contiguous blocks, making the intervening streets of varying width.

Mr. Smithwick, the second panel member, demonstrated a vast fund of knowledge of the past and present condition of San Francisco property boundaries by giving a detailed history of property surveys since the 1906 earthquake. He stated that the earthquake and fire destroyed all maps, field books, and other records of the City Engineer's Office, except for four field books which were in the pockets of field crew members; that the earthquake moved some city monuments as much as two or three feet, and that, as a result, there have been many disputes and court cases. The situation, he said, is further complicated by the fact than many of the early surveys were based on the *vara,* a Spanish unit of measure, and many early Spanish measurements were made by the lariat method.

Mr. Mosher presented the point of view of the title companies. He stated that the ever changing location of the "ordinary line of high tide" has given title insurance firms some trouble in the East Bay towns. As the land has been resubdivided into smaller and smaller parcels, gaps or lappages have occurred in the last remaining parcels of blocks.

The California Coordinate System—how it should be used, the advantages in using it, why it isn't used more, and how its use can be accelerated—was the theme of discussion at the March 6, 1958, meeting of the Northern California Section at Salinas. Among the many who attended the evening discussion were two who traveled from Redding, 325 miles away.

The speakers for the evening, introduced by Charles A. Wooldridge, Jr., Moderator, were Wendell W. Ray, District Locations Engineer of District V of the State Division of Highways, and Clarence Dake of the Monterey County Surveyors Office. The third speaker, Warren Gonnason, Director of Public Works of the City of Fremont, was unable to attend, but he extended an invitation to all present to visit his office and learn about the surveying and mapping program of the City of Fremont, which has recently received high praise.

Mr. Ray discussed the use of the California Coordinate System and photogrammetry by the Highway District. He stated that the latest contracts for photogrammetric mapping specify T-bars at about 800-foot intervals along the proposed route with second-order control, vertical as well as horizontal. Following construction, survey monuments are set on centerline and the route retraversed for determination of final coordinate values. This is a part of a long range plan to determine correct values for all monuments.

Mr. Dake read a letter from O. E. Anderson, County Surveyor of Alameda County, outlining the system of filing control data practiced in that county. This system, described in SURVEYING AND MAPPING, April–June 1954, page 201, is based on the California Coordinate System and standardizes the record forms and filing system for control data. All data for each monument are recorded on a tracing paper form from which diazo prints can be immediately produced when copies are desired by the surveyor.

Much of the discussion which followed the talks concerned the need for releasing data on the control established in the preliminary surveys prior to highway construction. It was felt that, even though these monuments might later be destroyed in construction, they had great value to private surveyors for so long as they stood.

George Bestor, Vice President of ACSM for 1958 and Chairman of the coming Western Regional Conference to be held in Monterey, Calif., October 9 to 11, 1958, explained that new equipment and methods will be emphasized at the conference as an incentive to induce attendance from all States west of the Mississippi River.

For its second meeting in March, the Section joined with the Sonoma, Lake, and Mendocino Counties Civil Engineer's and Land Surveyor's

Association for a dinner meeting at Ukiah on March 21, 1958.

Bad weather in the form of an exceptionally severe storm failed to limit the attendance at the meeting which, like the March 6th meeting, featured a discussion of monumentation under the California Coordinate System.

Prof. C. J. Aggeler, City College of San Francisco, outlined the Coordinate System and its underlying theory. R. C. Harkness, District I, California Division of Highways, explained monumentation under the system by Highway District I and the use of these monuments by private property surveyors.

—PAUL J. DOWLING
Section Editor

Southern California Section

Awards were recently presented by the Southern California Section to the following outstanding students in the surveying and mapping field: Richard Fischer, Riverside City College; Richard S. Pierce, San Bernardino Valley College; Paul Flygar, Los Angeles City College; Jesus Rodriquez, Pasadena City College; Anthony F. Lillie, Loyola College; and William G. Gustafson, Orange Coast College. These awards consist of one-year memberships in both ACSM and the Southern California Section.

The officers and directors of the Section for 1958 are as follows:

Harvey E. Rookus, *Chairman*
Albert V. Cocking, *Vice Chairman*
Reynold L. Pedersen, *Secretary*
Joseph J. Cooper, *Treasurer*
Robert T. White, *Editor*
Forrest M. Burke, *Director*
A. Clarence Johnson, *Director*
Robert J. Kadow, *Director*
Selwyn Douglas, *Jr. Past Chairman*

—REYNOLD L. PEDERSEN
Secretary, SCS

On Friday afternoon, March 21, 1958, the Southern California Section held its Fourth Annual Drafting Clinic at Los Angeles Trade Technical Junior College. This affair, by now a well established institution, was attended by 175 members and their guests. Among the guests were many students of the college who were urged to attend by their instructors.

Among the innovations this year was a display of the many types of maps and drawings prepared by the local surveying and engineering concerns represented by the officers and board of direction of the Section. These included an interesting map prepared by the Auto Club of Southern California showing the various stages in the preparation of a complete road map in color, and drawings furnished by several oil companies showing surface and subsurface methods of mapping.

Also included were drawings prepared by the City of Los Angeles, the County of Los Angeles, and the State of California. These were in various stages of completion so as to show what is necessary in the way of drawings to handle all the many and varied types of engineering in which these governments are engaged.

—R. T. WHITE
Section Editor

Joint Meeting, Northern California Sections of A.S.P. and A.C.S.M.

The Northern California Sections of both the American Congress on Surveying and Mapping and the American Society of Photogrammetry held a joint meeting at Sacramento, Calif., on April 25, 1958, at which a panel discussed the subject "Control Surveys for Photogrammetry."

The panel members and their subjects were:

A. E. Letey, U. S. Geological Survey, "The Application of the Tellurometer."

J. D. Carter, State Division of Highways, "The Application of the Geodimeter."

D. R. Mayer, Clair A. Hill & Associates, "The Application of Photogrammetric Methods."

Professor C. H. Drown, Engineering Department, Sacramento State College, acted as moderator.

Joint Meeting, Northern and Southern California Sections

A joint meeting of the Northern and Southern California Sections of the American Congress on Surveying and Mapping was held at the Miramar Hotel, Santa Barbara, California, on May 2–3, 1958.

Friday, May 2nd, the afternoon was devoted to registration, commercial exhibits, and a tour of an orchid farm for the ladies. The evening was devoted to a cocktail party and a dinner.

Saturday, May 3rd, the period from 9:00 to 11:00 a.m., was given over to registration, exhibits, and demonstrations. A Joint Directors Meeting was held at 10:00 a.m. From 11:00 on until noon, the time was devoted to introductions and Sectional and National Reports.

The afternoon, beginning at 2:00 p.m., was given over to the presentation of the following papers:

"IBM Model 610 Autopoint Computer," by James Dowd.

"Guided Missile Survey Problems," by Commander R. F. Freitag, USN, Pt. Mugu.

"Photogrammetry," by Rex Fulton, California Division of Highways.

Following the presentation of the above papers, an Open Forum on General Surveying Problems was held. Another cocktail party paved the way for the dinner dance which concluded the formal part of the program.

Sunday morning, an informal breakfast was held, after which those attending left for their various homes.

New St. Louis Section

Formation of the St. Louis Section of the American Congress on Surveying and Mapping was approved during the 18th Annual Meeting of ACSM, following petition by over thirty ACSM members from that area. Frank A. Clemens, chief of cartographic operations at the Aeronautical Chart and Information Center located in St. Louis, Mo., has been named acting chairman of the new Section by ACSM President W. B. Williams. The St. Louis Section of ACSM has adopted the broad concept of ACSM for its activity objective and includes committees on Cartography, Control Surveys, Education, Instruments, Property Surveys, and Topography, as constitutional objectives in parallel with ACSM Divisions, in the Section's standing committees. St. Louis thus becomes the eighth Section in ACSM.

Texas Section

The first 1958 quarterly meeting of the Texas Section was held on March 7 at John's Restaurant in Houston. Sixty-three members and guests were present for the dinner and the business and technical sessions which followed.

Leonard E. Cornitius, Section Chairman for 1958, opened the meeting with an introduction of guests and a presentation of the new committee chairmen. Section Treasurer Howard E. Bush, Jr., gave a report on finances, disclosing that the balance on hand was over $600. Motions were passed to change the by-laws to make dues payable on February 1 of each year rather than on January 1, and to drop from the roster any members two years in arrears in payment of dues. Chairman Cornitius announced the dates for subsequent 1958 meetings of the Section to be June 6, September 5, and December 5.

Program Chairman John O. Phillips introduced the guest speaker for the evening, Ralph S. Ellifrit, Director of City Planning, Houston. Mr. Ellifrit explained the role of city planning in the development of metropolitan areas. He stressed the importance of zoning to protect residential areas, the importance of high-volume traffic arteries such as freeways and arterial city streets, and the need for coordination of city planning departments with other agencies, especially in a rapidly growing city such as Houston.

—Ellis S. Allen
Section Editor

Personals

Captain **Henry W. Hemple,** Coast and Geodetic Survey (Retired) and Treasurer of the American Congress on Surveying and Mapping, received the Illinois Institute of Technology Alumni Distinguished Service Award of 1958 at special ceremonies in Chicago on May 2, 1958. This award is made annually to an alumnus of the Institute in recognition of outstanding work in science and technology.

Captain Hemple, who served for more than 35 years in the Coast and Geodetic Survey and was Chief of the Division of Geodesy from 1945 to 1952, has been a very active member of ACSM. He was Chairman of the Control Surveys Division and has been serving as Treasurer since 1956. The members of ACSM congratulate him on receiving this high honor.

Archie T. Munson retired from the U. S. Geological Survey on April 30, 1958, after nearly 35 years of government service. He was born in Georgetown (D.C.) on September 26, 1899; he attended Jefferson High School in Falls Church, Va.; graduated from Central High School in the District of Columbia; received the BS degree in civil engineering from Valparaiso University; and began his service for the government as a rodman with the Corps of Engineers in June 1917. A year later he joined the geological Survey and spent 20 years on topographic surveys in the field. His retirement completes a twelve-year trick in the Map Information Office of the Geological Survey.

Mr. Munson, a member of ACSM, is President of the Falls Church Lions Club, a member of the Masonic Order, and is active in the Pick and Hammer Club of the Geological Survey. For seven years he was a member of the Falls Church City Council and now serves as vice chairman of the Cemetery Board and chairman of the Fairfax County Draft Board.

Gordon E. Ainsworth, ACSM member from South Deerfield, Massachusetts, was named by President W. B. Williams to be ACSM's official representative to the annual meeting of Quebec Land Surveyors (Corporation des Arpenteurs-Geometres de la Province de Quebec) at the Chateau Frontenac in Quebec, Canada, April 16–18, 1958.

Professor **Ralph P. Black,** formerly in charge of surveying instruction at the Georgia Institute of Technology, has retired.

Captain **Charles A. Schanck** retired from the Coast and Geodetic Survey on March 31, 1958, after thirty-two years service with the Bureau. On that date a very pleasant farewell luncheon was held in the International Room of the Occidental Restaurant in Washington, D. C., with 145 persons in attendance. Captain and Mrs. Schanck are planning on several months of touring in Europe before settling down to the real business of being retired.

Rear Admiral **H. Arnold Karo,** Director, Coast and Geodetic Survey, received an honorary Doctor of Science degree at Union College, Schenectady, N. Y., on February 25, 1958.

Granville K. Emminizer, Austin C. Poling, and **William Shofnos** each received the Department of Commerce "Meritorious Service Award" at ceremonies held in the Department of Commerce Auditorium, Washington, D. C., on February 12, 1958.

Lieut. Comdr. **Don A. Jones,** Coast and Geodetic Survey, is in Ethiopia as Chief of the Point IV group for the Water Control Project of the Blue Nile Area.

Ralph Moore Berry, Professor of Surveying and Geodesy at the University of Michigan, has associated with the surveying and engineering firm of Williams and Works, Grand Rapids, Mich., as a consultant on control survey problems.

Deaths

Chandler H. Barron, Civil Engineer and Surveyor, 21 Longfellow St., Portland, Oreg., passed away January 7, 1958. Mrs. Barron, in notifying ACSM of the death of her husband, wrote, "He was very proud of his membership in the American Congress and thoroughly enjoyed the Quarterly Journal."

A communication mailed from Monterey, Calif., on April 23, 1958, by the Western Regional Conference, to **Frank Z. Howard,** 208 Willits Bldg., Klamath Falls, Oreg., was returned marked "Deceased." No further information is presently available.

(Continued on page 260.)

NEW MEMBERS

INDIVIDUAL MEMBERSHIPS

ALLAN, Mrs. Carre A., Department of Economic Development, Capitol Annex, Frankfort, Ky.—Map Librarian

ALLEN, John H., Jr., Room 426, 1207 Grand Ave., Kansas City, Mo.—Land Surveyor with Tuttle, Ayers and Woodward Company

ANDERSON, Eddie, Lakewood, Wis.—Land Surveyor

ANDERSON, Wilmer J., 211 W. Lyon St., Rio, Wis. —Right-of-Way Agent, State Highway Commission

ANDREWS, Frank H., 500 Lincoln St., Worcester, Mass.—General Engineer, Plant Facilities Office, Watertown Arsenal

ARCHER, Alford, 711 Forston Drive, Takoma Park, Washington 12, D. C.—Geographer, Bureau of the Census

ARMSTRONG, Carl H., 111 Sunset St., Greeneville, Tenn.—Armstrong and Freeman, Surveying and Mapping

ARMSTRONG, E. C., Trenton, N. C.—Surveyor

BAKER, Glenn C., Box 448, Winnsboro, La.—Surveyor and Engineer, John W. Baker, Associates

BANE, John G., 226 N. Trade St., Winston-Salem, N. C.—Civil Engineer

BARBATO, George, 2210 C St., Sacramento 16, Calif.—Cartographer, U. S. Geological Survey

BARNETT, Fred A., 800 Commerce Bldg., New Orleans, La.—Party Chief, Continental Oil Co.

BARTICK, John J., Jr., 25 Marine St., Quincy, Mass. —Surveyor, Factory Mutual Engineering Division

BAUER, Albert A., Bldg. 25, Denver Federal Center, Denver 2, Colo.—Cartographer, U. S. Geological Survey

BEERY, Edgar W., 632 30th St., Manhattan Beach, Calif.—Survey Party Chief, Rosenthal Engineering Co.

BEN, Constantine, 407 Fisher Bldg., Detroit 2, Mich.

BETTIS, Donald L., 1134 Linda Vista, Pasadena 3, Calif.

BINGHAM, William P., 936 Rose Circle, S.W., Atlanta 10, Ga.—Land Surveyor, Bracewell, Shirey and Nelson

BIVINS, J. K., P.O. Box "O", Greggton, Tex.—Civil Engineer, Magnolia Petroleum Co.

BOURNE, Robert G. B., 2729 Van Dyke Ave., Raleigh, N. C.—Consulting Engineer, State of North Carolina

BOYD, Lt. Gerald M., 542 Engineer Co., APO 231, New York, N. Y.—Corps of Engineers, U. S. Army

BRADFIELD, John W., Jr., 316 Wilder Bldg., Charlotte, N. C.—President, Mecklenburg Engineers and Contractors, Inc.

BREZINA, Grant A., Box 897, Dodge City, Kans.— Engineer, Davis and Razak

BUFORD, Robert L., 732 Armstrong St., Kansas City, Kans.—McKinnell & Buford, Engineers and Surveyors

BUGGERT, Raymond W., Route, 1, Box 306, Grantsburg, Wis.—Land Surveyor

CALHOUN, Delmar E., Engineering Dept., Fort Lewis A. and M. College, Durango, Colo.—Instructor of Engineering

CARDARELLE, John E., 5205 Valley View Road, Minneapolis 24, Minn.

CARIGAN, James M., 4516 Blenheim Road, Louisville 7, Ky.—Aerial Engineer, Kentucky State Dept. of Highways

CARNEY, John L., 1902 15th St., N., Arlington, Va. —Geographer, Army Map Service

CASS, Albert, County Superintendent of Highways, Port Jefferson, N. Y.

CHRISTOFIS, Christ N., Room 3218, 30-50 37th St., Long Island City 3, N. Y.—Cartographer, United Nations

CORBIN, Jack, 1790 13th St., Chehalis, Wash.

COREY, W. Robert, 213 Fisher Drive, Falls Church, Va.—Geographer, Army Map Service

COYNE, Gerald T., 739 Superior St., S.E., Minneapolis 14, Minn.—Land Surveyor, Cartwright and Olson

CRAIG, Homer, 1104 N. Orchard Drive, Farmington, N. Mex.—Chief Draftsman, San Juan Division, El Paso Natural Gas Co.

CRAMER, Harry M., 130 N. 24th St., Quincy, Ill.— Supt., Artcraft Co.

CUNNINGHAM, Wesley N., 863 Bruce Dr., Palo Alto, Calif.

CURTIS, Doyle R., 1065 Pearl St., Apt. 302, Denver 3, Colo.—Senior Surveyor, Denver area

DAVIES, Henry I., 1034 Beverly Drive, Oxnard, Calif.—Civil Engineer, U. S. Naval Air Missile Test Center

DAVIS, Thomas C., 6247 4th Ave., Sacramento 17, Calif.—Engineer, State Dept. of Water Resources

DEGEN, John F., 715½ Pine St., Burlington, Wis.— Surveyor, Degen Engineering Co.

DELANEY, Robert, 86 Stevens Drive, Holbrook, Mass.—Civil Engineer, Yunits Engineering Co.

DOLAN, Paul P., 59 Iona St., Providence, R. I.— Land Surveyor

DOLE, Mrs. Freda H., 330 East 10th Ave., Apt. 411, Denver 6, Colo.—Cartographer, U. S. Geological Survey

DOLL, Paul N., P.O. Box 355, Jefferson City, Mo.— Executive Director, Missouri Association of Registered Land Surveyors

DONA, David L., 4932 White Oak Ave., Encino, Calif.—Survey Party Chief, City of Los Angeles

DUKE, William B., P.O. Box 514, Washington, N. C. —Land Surveyor

DUNLAP, Joseph D., 7525 W. Greenfield Ave., West Allis 14, Wis.—City Engineer

DUPUY, Vernalle, 2321 S.E. 26th Ave., Portland 15, Oreg.—Civil Engineer, Bonneville Power Administration

DYE, G. Harlan, 4347 Avon Drive, La Mesa, Calif. —Land Surveyor

ELLIOTT, Richard J., 106 Columbian Bldg., 114 West 6th St., Topeka, Kans.—Asst. Director, Urban Renewal Agency of Topeka

ELY, Alex W., 2630 Mason St., Madison, Wis.—City Engineer, Edgerton, Stoughton and Sun Prairie

ENGELHORN, W. A., 530 N. 9th St., Milwaukee 12, Wis.—Branch Manager, Charles Bruning Co., Inc.

FAGERHOLM, Per Olof, Sjokartebyran, Stockholm 100, Sweden

FARLEY, Jack P., Route 3, Box 375, Placerville, Calif.—Rodman-Chalman with Road Dept., El Dorado County

FEENSTRA, William T., 831 Sylvan Blvd., Redlands, Calif.—Civil Engineer, Dept. of Highways

FERARESE, J. A., 1441 South Clermont St., Denver 22, Colo.—Cartographic Draftsman, U. S. Forest Service

FERREE, Chas. W., Aerial Surveys, Inc., 4614 Prospect Ave., Cleveland 3, Ohio—Surveyor

FERRIN, Warren, P.O. Box 604, Glenwood Springs, Colo.

FINDLAY, James, Findlay-Withers & McConnaughey, 315 South St., Gastonia, N. C.—Partner, Findlay-Withers & McConnaughey

FINE, Morton S., 19 Whitney St., Hartford, Conn. —Civil Engineer and Land Surveyor

FIORLETTI, Armand A., 111 East Munsell Ave., Linden, N. J.—Land Surveyor

FISCHER, Adam, 1202 N. Jeffferson Ave., Springfield, Mo.—Engineer, Public Works Dept.

FISCHER, Richard, 1011 La Cadena Drive, Riverside, Calif.—Student, Riverside Junior College

FLYGAR, Paul, 3428 West Blvd., Los Angeles 16, Calif.

GARAY, Alberto, Enrique Palacios 562-4, Miraflores, Lima, Peru, S. A.—Draftsman, Northern Peru Mining Corp.

GAUTHIER, Dennis A., Bamlett Bldg., 630 8th Ave., W., Calgary, Canada—Chief Draftsman, Canadian Fina Oil Co., Ltd.

GLASER, Floyd E., 10853 Camarillo St., North Hollywood, Calif.—Engineer, California State Highway

GOETTEL, Marshall J., 116 Kuhl Ave., Syracuse 8, N. Y.—Surveyor, Niagara Mohawk Power Corp.

GOODMAN, John L., 2015 Park Road, N.W., Washington, D. C.—Research Specialist, Army Map Service

GOVE, John R., Box 1312, Hendersonville, N. C.—Consulting Engineer

GRANT, James D., 3804 Alfred Place, Jefferson Branch, New Orleans 21, La.—Party Chief, Humble Oil and Refining Co.

GRIFFITHS, D. M., 4016 Via Picaposte St., Palos Verdes Estates, Calif.—Senior Civil Engineer, Humble Oil Co.

GRIMM, Kenneth B., Jr., 713 Jefferson St., Fairfield, Calif.

GROSSMAN, David F., 327 McLennan Dr., Fayetteville, N. Y.—Land Surveyor, Roswell W. Cull and Associates

GURSKY, Peter P., 133 Orchard Drive, East, North Syracuse, N. Y.—Plant Engineer and Land Surveyor, Onondaga County Water Authority

GUSTAFSON, William G., 2191 Harbor Blvd., A-8, Costa Mesa, Calif.

HAMBER, Frederick C., Fennel Instrument Corp., 45–22 Pearson St., Long Island City, N. Y.

HATHORNE, Raymond C., U.S. Geological Survey, Box 4197, Sacramento 21, Calif.—Cartographer

HEINRICH, Edwin W., 24 Loretta Rd., Waltham 54, Mass.—Manager, Instrument Division, Carl Heinrich Co.

HEISER, James R., Box 4197, U. S. Geological Survey, Sacramento 21, Calif.—Cartographer

HELMKAMPF, A. Fred, 804 Pine St., St Louis 1, Mo.—President, Pitzman's Company of Surveyors and Engineers

HENDRIX, B. H., Court House, Woodland, Calif.—Deputy County Surveyor, Yolo County

HENNINGER, Henry, 228 Maple Lane, North Syracuse 12, N. Y.—Land Surveyor, H. Henniger and L. H. Jones

HEUVELMAN, David B., Instrument Sales Co., Richmond, Ill.—Surveying Instrument Manufacture and Repair Station

HILL, Raymond E., U. S. Geological Survey, Bldg. 25, Denver Federal Center, Denver 2, Colo.—Cartographer

HILLIN, Kirby, Box 2880, Dallas 21, Tex.— Civil Engineer, Sun Oil Co.

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Tide Predictor Now Records Automatically

The Coast and Geodetic Survey has just installed a unique electronic instrument which makes it possible to type automatically, in a form suitable for direct reproduction, information on the tidal movements of the water the world over, as predicted by the Survey's tide predictor.

The instrument, called an Automatic Logger, permits a 40 percent reduction in the time required to print out the tides for one station for a year. The logger was designed especially for use with the Survey's tide predicting machine, and is the only one of its kind in the world.

With a touch of a finger the operator can electronically control a mechanical marvel that can solve mathematical equations in a time that cannot be approached by man. Simply stated, the new apparatus will convert the shaft position of the predicting machine into electrical pulses. An attached typewriter automatically types the information as it will appear in the annual tide and current tables.

The glass-enclosed tide predicting machine, in operation since 1910, is 11 feet long, 2 feet wide, 6 feet high, and weighs a little over a ton. It was designed by R. A. Harris, a Bureau mathematician and world-renowned tidal scientist, and E. G. Fischer, then Chief of the Division of Instruments.

Prior to the installation of the new equipment, an operator methodically cranked the machine by hand and recorded the readings for the times and heights of high and low water at a station for each day of the year. For the prediction of tides this required about 10 hours, and for currents about 14 hours. The Automatic Logger, which was designed by the Fischer and Porter Company, will do the same job in a little over half the time required previously. The new

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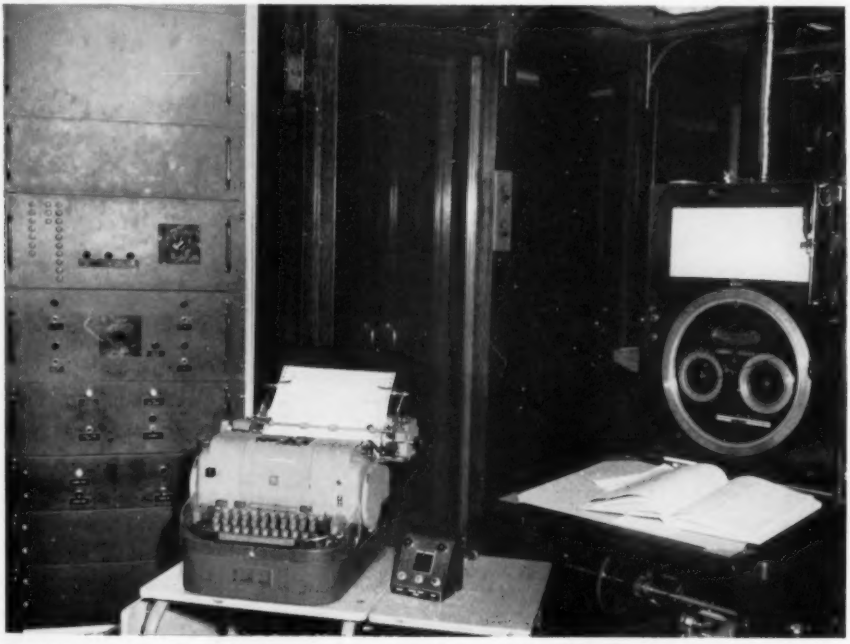
logger has been under construction for about two years.

To reduce the work load on the tide predicting machine, which is now becoming worn and needs a thorough overhaul after almost 50 years of service, and for security reasons, a second machine is being built. It was decided that the reliability and simplicity of the original mechanical device were so desirable that the new machine would follow the original mechanical principle. The new machine is about half completed.



In this view, the end of the Coast and Geodetic Survey Tide Predicting Machine shows at the right, while the new equipment which provides for the automatic recording of the results is shown at the left.

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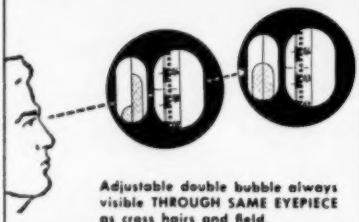

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(Continued from page 250.)

Robert M. Benjamin, known to a great many members of ACSM as the genial gentleman who presided over the Lufkin booth at the co-exhibits in recent years, was killed in the plane crash at Saginaw, Michigan, Easter Sunday evening, April 6, 1958. He was returning to Saginaw from a business trip to Washington, D. C., which included his attendance at the ACSM–ASP Convention as the representative of the Lufkin Rule Company.

Mr. Benjamin was an accepted authority in government and educational circles on the subject of measuring tapes and rules. He enjoyed a wide acquaintanceship among government officials, personnel of the U. S. Bureau of Standards, engineering colleges, and distributors. He joined the Lufkin Rule Company on January 1, 1917, and for the most of the next thirty years he traveled in a sales capacity throughout the States east of the Mississippi River. During World War II he had his headquarters in Washington, D. C. He went to the main office of the company in Saginaw in 1947 as Promotion Manager.

His many friends in ACSM will mourn his tragic and untimely death.

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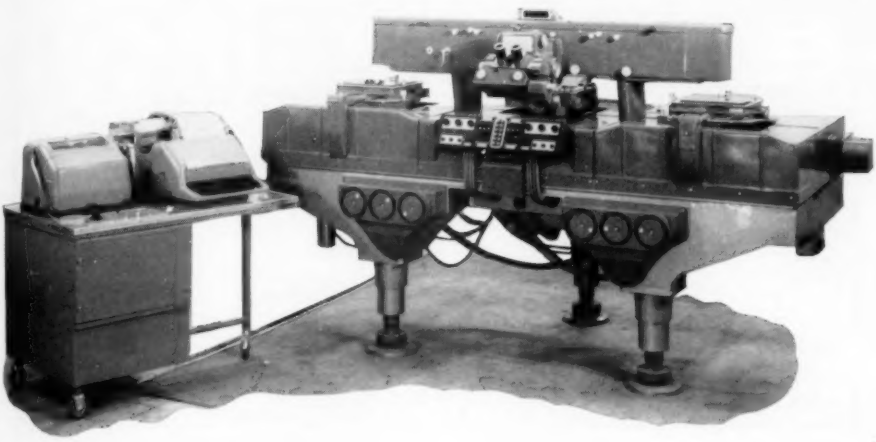

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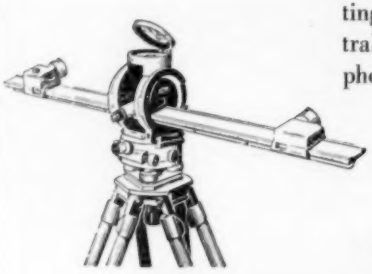

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Alexander is New President of A. S. E. E.

At a meeting of the Southeastern Section of the American Society for Engineering Education in April it was announced that William T. Alexander, Dean of Engineering at Northeastern University was elected president of ASEE for the year beginning July 1, 1958.

Clarence L. Eckel, Dean of Engineering at the University of Colorado, was re-elected vice president in charge of regional activities in the western States.

Elmer C. Easton, Dean of Engineering at Rutgers University was named vice president in charge of activities of the Society's instructional divisions.

John Gammell, Director of Graduate Training at the Allis-Chalmers Manufacturing Company, was re-elected Treasurer of ASEE.

The Secretary of ASEE is Professor W. Leighton Collins, University of Illinois.

Graduate Theses on Geophysics

A bibliography of graduate theses on geophysics is the topic of Vol. 53, No. 1 of the *Colorado School of Mines Quarterly*. This reference work was compiled by George E. Tarbox, geophysical engineer, Pan-American Petroleum Corporation.

The bibliography lists 500 papers which were written in partial fulfillment of requirements for master's or doctor's degrees at 46 institutions in the United States, Alaska, and Canada. The papers cover the period from 1889 through 1956, with a partial list of 1957 papers included.

The papers are listed in three separate sections of the *Quarterly* by subject, author, and school of origin.

This bibliography may be obtained from the Department of Publications, Colorado School of Mines, Golden, Colo., for $1.00 per copy.

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IGY Bulletin

The National Academy of Sciences announces that the *IGY Bulletin,* official monthly publication of the U. S. National Committee for the International Geophysical Year, is now available by subscription.

The *Bulletin* includes brief articles and reports on projects and experiments in a dozen different scientific fields covered by the US-IGY program as well as available news of IGY activities in other countries. The IGY programs covered are: aurora and airglow, cosmic rays, geomagnetism, glaciology, ionospheric physics, longitude and latitude, meteorology, oceanography, seismology and gravity, solar activity, world days and communications, and rockets and satellites. The monthly issues of the *Bulletin* comprise at least sixteen pages and are illustrated with charts, tables, and diagrams.

Subscription to the *Bulletin* is $4.00. This will include all back issues, dating from July 1957, together with all future issues. (The *Bulletin* will be published at least through December 1958 and possibly through June 1959.) Subscriptions should be sent to the Publications Office, National Academy of Sciences, 2101 Constitution Avenue, Washington 25, D. C.

1959 ASP-ACSM Convention

Dates for the 1959 ASP-ACSM Convention have been set as March 8–14, 1959. This convention will be held at the Shoreham Hotel, Washington, D. C. It will be the 25th annual meeting of ASP—their silver anniversary—and the 19th annual meeting for ACSM. This will also be the 5th in the series of cooperative conventions.

John H. Wickham, Jr., Washington representative for Aero Service Corporation, will be the Convention Director. He will be assisted by Thomas A. Hughes, a member of the Research and Technical Control staff of the U. S. Geological Survey, who will be Deputy Director. Captain John H. Brittain, Chief, Division of Geodesy, Coast and Geodetic Survey, has been named Program Chairman for the 19th annual meeting of ACSM.

DOES CANADA LEAD THE U.S.A.?

During the past few years, many copies of **"RAPID TRAVERSE TABLES"** with its patented calculator have been purchased by surveyors and engineers in Canada.

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(Continued from page 161.)

scale surveying operations the crew will consist of 21 officers and 90 men.

In keeping with its primary purpose, the *Surveyor* will be equipped with a variety of electronic surveying equipment. Plans also include provision for photographic and oceanographic laboratories and reproduction facilities for the field surveys.

The *Surveyor* has been designed for operations in remote localities such as the Aleutian Islands and the Bearing Sea area. With this in mind the hull structure has been reinforced for navigation in ice. The ship will operate as an expedition in these remote regions and will remain in the working area from April until September.

Report on Scribing—Part One

Part One—Scribing Applied to Modern Cartography—of the Report on Scribing in the United States* was issued in March 1958 by the Inter-Agency Committee on Negative Scribing. This 16-page, lithographed pamphlet has a page size of 8 by 10½ inches; is punched to fit standard three-ring binders; includes nine illustrations, plus a generalized "flow diagram;" and has a bibliography, with entries ranging from 1942 to 1956, inclusive. We fail to find in this publication any information as to where it may be obtained or as to the price, if any.

It is interesting to note that of the 58 entries in the bibliography five refer to papers published in SURVEYING AND MAPPING. —EDITOR

* *See* "Forthcoming Report on Scribing in the United States," by Kenneth R. Deardorf, SURVEYING AND MAPPING, Vol. XVII, No. 4, October-December 1957, pages 423–424.

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SERVCO RIBBON FLAGGING

A new embossed surface ribbon flagging made of Ultron vinyl film manufactured by Monsanto Chemical Co., has been introduced by Surveyors Service Co. The manufacturer indicates that use of the embossed vinyl brings new characteristics to flagging. Uniquely flexible, yet of great toughness and strength, the new Servco ribbon flagging handles with unusual ease.

The Servco flagging is non-toxic and flame resistant, will not fade or stiffen upon prolonged exposure to sunlight and is supple at temperatures as low as minus 35° F. Supplied in a new compact pocket-size 300-ft. roll, the flagging is available in brilliant orange, yellow, blue, red, or white. Other features claimed for the new embossed Servco flagging include the ability of the surface to be easily written on with a ball-point pen or pencil and also the fact that the tape tears cleanly, without waste.

Complete information is available from the manufacturers: Surveyors Service Co., 2021 South Grand Ave., Los Angeles 7, Calif.

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ERRATUM

In the Table of Contents, page 5 of the January–March 1958 issue of SURVEYING AND MAPPING, line 15, the author's name should read "Philip H. Douglin"— not "Philip H. Douglas," as printed. The editor's face is very, very red, and he apologizes.

GURLEY EPHEMERIS—1958

The 1958 edition of the *Gurley Ephemeris* is now available and will be sent free on application to practicing engineers and surveyors and to instructors and students of surveying.

For the third year this ephemeris features charts designed to simplify and speed up computation of the azimuth of Polaris. The 1958 edition also includes a four-page supplement covering the use and adjustment of the optical plummet.

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CHART-PAK ABSORBS TRANSOGRAPH

Chart-Pak, Inc., Leeds, Mass., has announced the purchase of the Transograph Company, New York, N. Y. Patents, trade marks, machinery, and inventories of Transograph have been taken over by Chart-Pak, and all production facilities have been moved to the new Chart-Pak plant at Leeds, where the Transograph Division of Chart-Pak will continue to manufacture and distribute all former Transograph products.

NEW TYPE OPTICAL PLUMMET

Another new type of optical plummet is being offered by the Warren-Knight Company. This one permits setting up over the point by means of sights through the transit telescope. The instrument can be set *under* the point by using the telescope in the reversed position. The device can be attached to many existing transits. For further information, write the Warren-Knight Company, 136 North 12th St., Philadelphia 7, Pa.

MEETINGS

PAST, PRESENT, AND FUTURE

The Quebec Land Surveyors (Corporation des Arpenteurs-Geometres) met at the Chateau Frontenac, Quebec, Canada, April 16–18, 1958.

The 39th Annual Meeting of the American Geophysical Union was held in Washington, D. C., May 5–8, 1958. It is of some interest to note that, for the ten papers that were presented at the two sessions of the Section of Geodesy, five of the eleven authors involved are members of ACSM.

The Second International Cartographic Conference, sponsored by Rand McNally & Co., Chicago, Ill., was scheduled for June 15–21, 1958, with meetings to be held on the campus of Northwestern University, at Evanston, Ill.

A meeting has been scheduled for June 23–27, 1958, in Washington, D. C., sponsored by ACSM and ACSM's Cartography Division, which will be a sort of continuation of the Second International Cartographic Conference.

In January 1959, ACSM will join cooperatively with the Land Surveyors Division of the New Jersey Society of Professional Engineers in staging a meeting on the campus of Rutgers University, New Brunswick, N. J.

March 8–14, 1959, are the dates set for the 1959 ASP-ACSM Convention and Co-Exhibit, to be held at the Shoreham Hotel, Washington, D. C. For further details see page 263.

NEW RELIEF GLOBE*

A new 12-inch relief globe, accurately modeled with the relief exaggerated to 30 times the scale of the globe, is now on the market. Made of durable pale blue, washable plastic, it has an aluminum stand.

Information can be drawn or painted on the globe, and then erased or washed off as often as desired to change to a new set of facts.

NEW MONSEN PRODUCT

For many years, names, symbols, numerals, and similar typographic detail have been applied to drawings and maps by burnishing down clear acetate on which the desired material has been printed. The adhesive on these impressions has a wax base and is ideal for use on all artwork to be copied or reproduced by a "cool" process such as photography. However, when drawings were passed through hot-process machines typographic detail would peel off or shift in position on the drawings.

To lick this problem Monsen Typographers, Inc., Chicago, has developed a new heat-resisting adhesive that holds all typographic detail firmly in place at high temperatures. It is the new Monsen HR-Heat Resisting Trans-Adhesive Impression.

For full details and samples of Monsen HR-Heat Resisting Trans-Adhesive Impressions write to Monsen Typographers, Inc., 22 E. Illinois St., Chicago 11, Ill. (See advertisement on page 134).

MONTHLY MEAN LEVELS OF THE GREAT LAKES

An interesting hydrograph has been published by the U. S. Lake Survey. It shows monthly mean levels for Superior, Michigan-Huron, St. Clair, Erie, and Ontario for the period from January 1950 to February 1958. The sheet is approximately 8 by 19½ inches in size. The vertical or height scale is 1 inch = 2 feet, and the time scale is approximately 19/32 inch = 1 year. While we have no definite information, it is presumed that this hydrograph is available to interested persons or organizations. Address the U. S. Lake Survey, 630 Federal Building, Detroit 26, Mich.

NEW GURLEY BOOKLET

A 36-page, pocket-size service booklet on the use and adjustment of alidades has been published by W. & L. E. Gurley. This revised edition of Service Booklet "C" includes, for the first time, tables by which the field man can obtain horizontal distances and differences of elevation from stadia readings.

This illustrated booklet also includes information on the use of the alidade in both exploration and mapmaking, as well as detailed instructions on stadia surveying and the use of the Beaman Stadia Arc.

Free copies of this booklet may be obtained by writing: Alidade Department, W. & L. E. Gurley, Troy, N. Y.

YOU MAY BE INTERESTED TO KNOW THAT

The Texas Engineering Experiment Station is planning to add a 701 IBM data processing machine to its already well equipped computing facilities.

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* See advertisement of page 265 of this issue of SURVEYING AND MAPPING.

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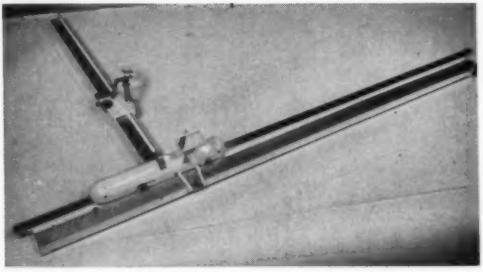

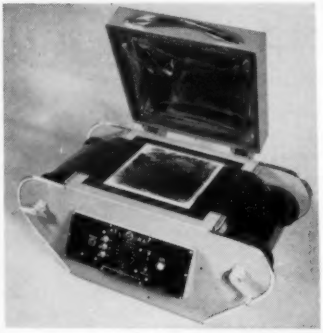

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Reprints in quantities of 50 or more may be obtained of any article appearing in this issue. Orders must be placed with the Editor-in-Chief, Howard S. Rappleye, 6712 4th St., N.W., Washington 12, D. C., not later than 3 weeks after publication. Authors who wish reprints of their articles may so indicate when manuscripts are submitted. Approximate prices of reprints follow:

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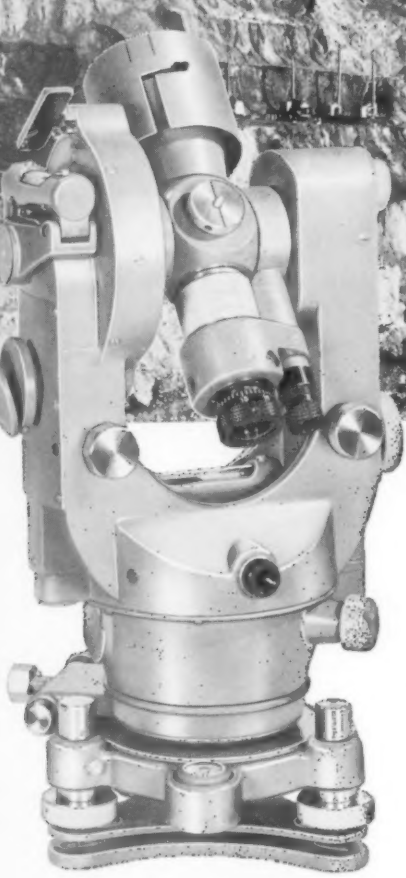

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